Telephony.

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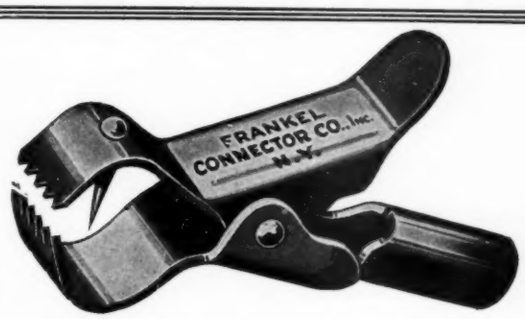

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Telephony

THE AMERICAN TELEPHONE JOURNAL

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CURRENT OPINIONS AND COMMENTS

Receipt of a booklet setting forth the code of ethics—or the "code of principles of professional conduct", as it is officially described—of the American Institute of Electrical Engineers is a reminder that a similar proposition is now pending before Independent telephone men.

At the national convention last November a resolution was adopted authorizing the president of the United States Independent Telephone Association to appoint a special committee to draft a code of ethics to be submitted at a subsequent meeting.

* * * *

That such a step is in the right direction is indicated by the fact that so many industries are adopting the plan of formulating codes, laying down general principles governing their relations within their own ranks and their relations with the public.

Within recent weeks the American Society of Mechanical Engineers has adopted such a code of ethics. The National Wholesale Men's Furnishers' Association has taken similar action.

* * * *

Those who have given the matter consideration, and have observed its working in other lines, believe that such a code of ethics, or conduct, would prove most beneficial to the telephone business. It could crystallize in definite terms effective ways and means to create and maintain relations between the companies and their employes that would produce the best results. Such a code also would contemplate improving the companies' relations with the public.

In short, it would deal with every angle that would help strengthen the position of those engaged in supplying the people with telephone service.

Such a declaration would be a platform on which the industry could stand for mutual benefit. It also would have an excellent effect on the general public as indicating that telephone men have a sound, well-defined plan and purpose of deserving, winning and holding the good opinion of the public.

* * * *

A glance at the code of the American Institute of Electrical Engineers shows that it is wisely designed to command the respect of the public. The keynote is found in this one sentence under the subject of general principles: "In all of his relations the engineer should be guided by the highest principles of honor."

Living up to that rule, it would seem that no one could go very far wrong in any direction.

* * * *

Specifically, the A. I. E. E. code covers principles of conduct regarding the engineer's relations to his client or employer, matters relating to records and data, the engineer's relations to the public, and his relations to the engineering fraternity.

Its whole purpose is to keep the profession on a high plane, and all agree that it has been a helpful, steadying influence during all the years since 1912, when the first draft was adopted. Its reaffirmation last year showed how sincerely the engineers value its inspiration.

Telephone men should draft a code that would apply to their industry. If President MacKinnon appoints a committee soon, it would be able to report to the national convention to be held in Chicago next October.

* * * *

Sleet storms and terrific gales have played havoc with telephone plants in many states within recent weeks. The South suffered from unusually cold and boisterous weather in January; the Middle West companies were damaged later, while an unusually severe winter, with unprecedented snows, has bothered the East steadily for months.

Weather disturbances, like sleet storms, are one of the big hazards of the telephone business. They cannot be prevented, nor anticipated, and guarded against only to a limited extent.

* * * *

Of course, a line correctly constructed and well maintained will resist a storm's destruction better than a slip-shod line with worn-out, ill-set poles and sagging wire, and for that reason good maintenance pays, but it is not humanly possible to escape entirely from storm damage. And that storm damage often means the expenditure of thousands of dollars for new equipment, labor and repairs, and much hard work to put the service back to normal.

This weather hazard explains why tele-

phone rates must be adequate to cover such exigencies. A private business damaged by fire, flood or storm can close down and re-open when it is convenient or profitable to the owner. The telephone company, and other utilities, when visited by such disasters, immediately set to work to resume giving service regardless of cost, convenience or anything else. Their controlling motive is to give the public service at once.

* * * *

This determination to meet an emergency at once shoots holes into the company's reserve funds, but it wins the approval of the public.

For example, read the following from the Dayton (Wash.) Chronicle:

"In the recent fire which wiped out 30 blocks in the city of Astoria, what were the first businesses to re-establish service?

"Public utilities.

"People were lost without electric light and telephone service, but before the smoke had cleared away these industries were stringing wires and giving the people service before any other line of industry had recovered from the shock of the fire.

"People take such conveniences as the telephone, power, light, gas and street railways as a matter of course. This is because these companies seldom fail to give service when the customer wants it."

* * * *

A large business concern in the East recently addressed a letter to its staff of salesmen, urging them to use the telephone more in their dealings with their customers. It emphasized the fact that the telephone provides a direct route to the attention of nearly every buyer, and offers fine opportunities to make friends and arrange for demonstrations or interviews—"if the tone of voice and manner of speaking are pleasing."

The point is then made that "telephone calls will lose both friends and sales if the manner of talking over the wire is not pleasing."

The precaution is undoubtedly wise, as are all suggestions that will help to cultivate courtesy and develop friendly relations, but the same advice equally applies to all communications—telephone, letter or face to face. Under any circumstances the brusque, curt or chilly manner never wins as much favor as the pleasant, genial mood.

* * * *

It is true that some persons are less genial in a telephone conversation than when speaking in the actual presence of the other fellow, but those who know how to use the telephone effectively are seldom guilty of this error.

The pleasant, courteous voice of the exchange operator—who above all others knows how to use the telephone—has almost come to be a recognized institution. Her experience shows how much it pays.

CONVENTION DATES.

The dates and places of meeting for the various state conventions to be held in the near future are as follows:

Florida, Roberts Hotel, Miami, March 27-28; New York Up-State, Powers Hotel, Rochester, April 18-20; Iowa, Ft. Des Moines Hotel, Des Moines, April 24-26.

Transmission Over Long Cables

Types of Toll Cable Circuits and Their Characteristic Echoes, Attenuations and Amplifications—Maintaining Stability of Transmission—Paper Presented at Milwaukee Meeting of the American Institute of Electrical Engineers

By Alva B. Clark
American Telephone & Telegraph Co.

This paper aims to present an idea of what is involved in the transmission of voice currents over long toll cable circuits. Because of the breadth of the subject covered, no attempt has been made to make the discussions of the various items complete, or to include many of the results of the experimental and theoretical work which contributed to a solution of the problems and which has involved the co-operative efforts of a large number of engineers and investigators. This paper should be considered merely as an introduction to the subject.

Different Types of Circuits.

The different types of circuits used in toll cables are illustrated in diagrammatic form in Fig. 1. Circuit *b* is a two-wire telephone circuit employing a 21-type telephone repeater. This type of circuit is employed only for handling connections on which but one telephone repeater is involved.

Circuit *c* is a typical two-wire circuit on which the familiar 22-type telephone repeaters are operated. Circuit *d* is of the four-wire type which employs two transmission paths, one for each direction. The function of the pilot wire circuits *a*, will be taken up later.

With the exception of circuit *b*, which possesses the limitation that it cannot advantageously be connected to another circuit containing telephone repeaters, the circuits shown may be connected, when required, to circuits of the same or other types, such as open-wire circuits, to build up various telephone connections.

In general, circuits such as *c*, employing 22-type repeaters, are used for handling connections of moderate lengths, while circuits such as *d* of the four-wire type, are employed for the longer connections where the transmission requirements are more severe.

In addition to employing the cable conductors for furnishing telephone service, these may also be arranged to furnish d-c. telegraph service. Apparatus for compositing the circuits so as to permit this superposition of the d-c telegraph is indicated on the drawing.

In general, the method of compositing the small gage cable circuits is the same as that employed for compositing open-wire lines. The telegraph circuits in cable, however, operate with a metallic instead of a grounded return and employ much weaker currents than those common on open wires. Telegraph currents employed in the cables are comparable in magnitude with the voice currents.

The two-wire circuits in toll cables employ conductors of No. 19 or No. 16 A. W. G. while for the four-wire circuits, No. 19 wire conductors are usually employed. (No. 19 wire weighs 20½ pounds per wire mile, or 5.8 kilograms per kilometer. No. 16 wire weighs twice as much.)

Loading Characteristics.

Two weights of loading are usually employed. These are commonly known as "medium heavy loading" and "extra long loading" and in this paper they will be referred to for brevity as "m. h. l." and "x. l. l." respectively.

The medium heavy loading employs coils having an inductance of about 0.175 henry in the side circuits, spaced 6,000 feet apart, (approximately 1.8 kilome-

ters); the extra light loading employs coils having an inductance of about 0.044 henry for the side circuits with the same spacing. The capacity per loading section for the side circuits is approximately 0.074 micrafarad.

The medium heavy loaded side circuits have a characteristic impedance of about 1,600 ohms, and a cut-off frequency of about 2,800 cycles. The extra light loaded side circuits have an impedance of about 800 ohms and a cut-off frequency of about 5,600 cycles.

Fig. 2 shows the attenuation-frequency characteristics of No. 19 and No. 16 side circuits with the two types of loading.

It will be observed that the m. h. l. circuits have lower attenuation for frequencies below about 2,500 cycles, as should be expected from the fact that the inductance per mile introduced by the loading coils is greater. However, the attenuation is more nearly equal at different frequencies in the case of the x. l. l. circuits, this being particularly true at the higher voice frequencies.

Another important characteristic of loaded circuits when repeaters are involved is their velocity of propagation.

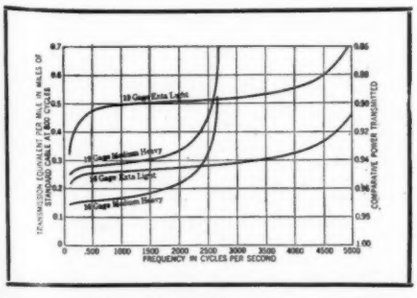


Fig. 2. Attenuation-Frequency Characteristics of Loaded Cable Side Circuits.

Since the inductance per mile of x. l. l. circuits is only one-fourth of that for m. h. l. circuits, the velocity of propagation is twice as great for the x. l. l. circuits as indicated by the well-known approximate formula $V=(LC)^{-\frac{1}{2}}$

Where V is the velocity in unit lengths per second, L is the inductance in henries per unit length and C is the capacity in farads per unit length, the unit of length for expressing velocity, inductance and capacity being the same.

The x. l. l. type of loading is best for the longer circuits, because of the more nearly equal attenuation of currents of different frequencies, its higher velocity of propagation which permits more efficient operation of telephone repeaters, and also its comparative freedom from transient effects, as will be explained in more detail later.

For the shorter circuits where these effects are not so important, the m. h. l. type is satisfactory electrically and is, therefore, employed, since fewer repeaters are required owing to lower attenuation.

As is well known, whenever points of discontinuity or unbalance occur in a telephone circuit, reflections of electrical energy take place. If the circuit is long so that the time for transmission is appreciable and if also the losses are not so great as to cause the reflected energy to become inappreciably small before it reaches the ear of a listener, echo effects will be experienced.

While, in general, reflections take place in any telephone circuit actual echoes are never appreciable unless telephone repeaters are employed. In the case of circuits with repeaters, the electrical length is usually great enough so that an appreciable length of time is required for the voice currents to travel to some discontinuity and back again. Furthermore, the repeater gains keep the reflected voice currents large.

It should be understood that the echo effects which are experienced in long repeatered circuits are due to the same unbalances, which, on shorter circuits, bring the trouble due to "singing," or distortion of the voice waves due to "near-singing."

On electrically long circuits, due to the comparatively great time lags involved, the echo effects become of controlling importance. Consequently, it is, in general, necessary on such circuits to work the repeaters at gains well below those at which "singing" or distortion due to "near-singing" is experienced.

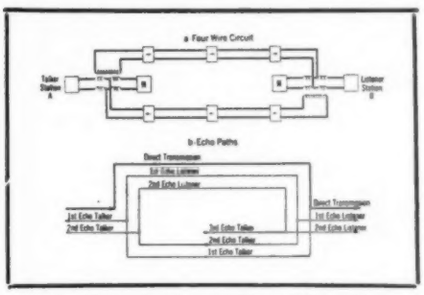


Fig. 3. Echo Paths in Four-Wire Circuit.

The echo effects which occur in four-wire circuits will first be discussed, since the effects are simpler in this case than they are in the case of a two-wire circuit.

Fig. 3-*a* shows a four-wire circuit in diagrammatic form, while Fig. 3-*b* shows the echoes which are caused by the unbalances at the terminals. When someone at terminal *A* talks to a person at terminal *B*, the heavy line in Fig. 3-*b* shows the direct transmission, which takes place over the top pair of wires in Fig. 3-*a*.

When this current reaches the distant terminal, part of it goes to the listener while another part, due to the imperfections of balance between the line and network at that terminal, travels back through the pair of wires at the bottom of Fig 3-*a* toward terminal *A*. The talker at terminal *A* will hear this current as an echo if the four-wire circuit is long enough so that the time lag is appreciable.

This first echo heard by the talker divides at terminal *A* in the same way as did the direct transmission at terminal *B*, part of it taking the upper path of Fig. 3-*a* back toward the listener. The listener will, therefore, first receive the direct transmission and then a little later an

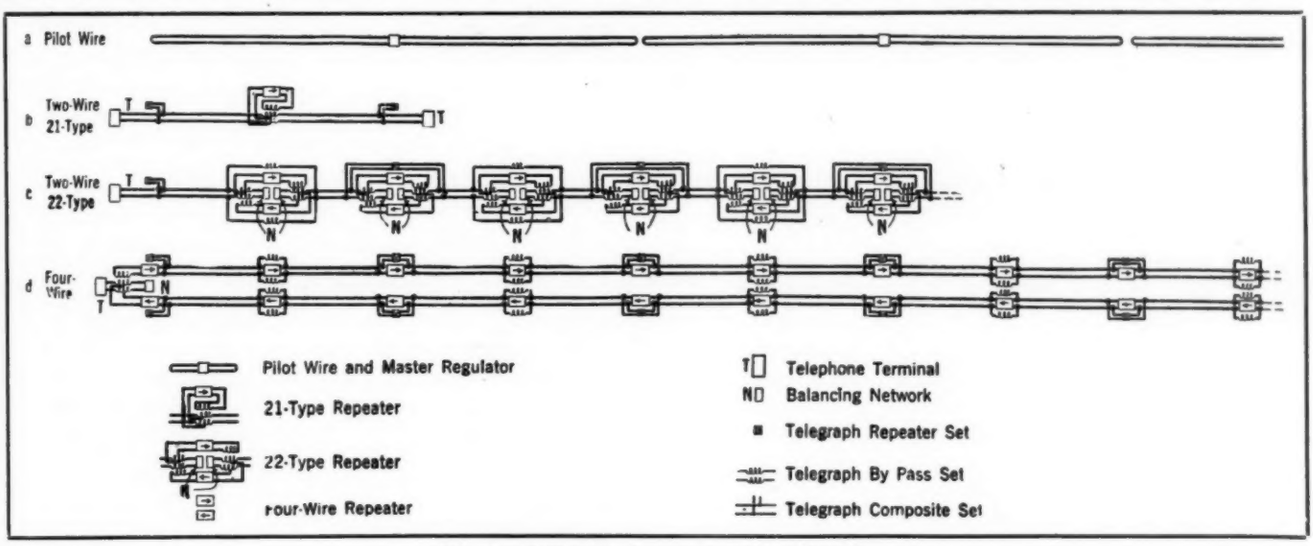


Fig. 1. Different Types of Cable Circuits.

echo. This process is repeated, producing successive echoes which are received at both terminals *A* and *B* as indicated.

A four-wire circuit 1,000 miles (1,600 kilometers) long has been set up in which the balances at the two ends were deliberately made poor so as to exaggerate the

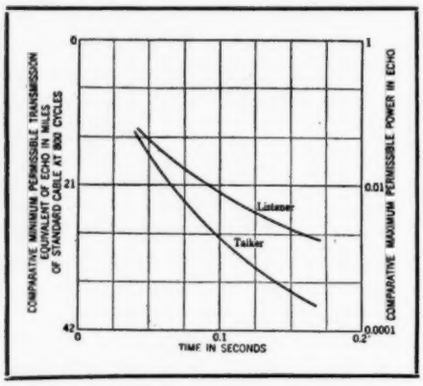


Fig. 5. Effect of Echoes on Talker and Listener.

effects. More than a dozen successive echoes could be heard before they became inaudible. Since for each echo the voice energy traveled 2,000 miles (3,200 kilometers) this energy must have traveled the distance around the world before becoming inaudible.

In order that a circuit will be satisfactory for regular telephone use, the echoes must be kept small as compared to the direct transmission. Evidently if the first echoes are small as compared to the direct transmission, the later echoes will be much smaller in magnitude. For example, if the power in the first echo, heard by the listener, is 1/10 as great as the directly transmitted power, the second echo will have only 1/100 as much power, the third echo 1/1000, etc.

The velocity of an x. l. l. circuit is approximately 20,000 miles (32,000 kilometers) per second, while the velocity with m. h. l. is only 10,000 miles (16,000 kilometers) per second. It is thus seen that the time required for voice energy to travel from one end to the other of an x. l. l. circuit 1,000 miles (1,600 kilometers) long is 0.05 second.

An echo traveling from one end of the circuit to the other and back again would, therefore, arrive 0.1 second behind the impulse which started the echo. With m. h. l. circuits these times are of course doubled.

Fig. 4 illustrates the condition existing in a two-wire circuit. For simplicity, the first echoes only are shown, the later echoes being less important owing to their comparative weakness as explained above. In such a circuit reflections occur not only at the terminals, but at a number of intermediate points in the circuit, the condition of balance between the networks associated with the telephone repeaters and the corresponding lines being necessarily imperfect.

This imperfection of balance is due in part to lack of perfect balance of the apparatus closely associated with the repeater, and in part to the small irregularities which exist in the make-up of any practical loaded line. A further cause is the reflection at the adjacent repeaters, due to the difference between the repeater impedance and the line impedance.

It will be noted that three sets of echoes are shown which affect the "talker." In addition to these which involve one or more repeaters, a comparatively small amount of power is reflected back to the "talker" from the various irregularities between the "talker" station and the nearest repeater. These reflections have not been indicated since their effects are of negligible importance.

Six sets of echoes affect the "listener." Both for the echoes affecting the "talker" and the "listener," the dotted lines indicate reflections from a number of different points where irregularities exist as explained above. In circuits containing a larger number of repeaters the numbers of sets of echoes affecting the talker and listener are, of course, greater.

The number of sets of first echoes affecting the talker is equal to the number of repeaters. The number affecting the listener is equal to $\frac{N\ (N+1)}{2}$

where N is the number of repeaters.

It is, of course, obvious, that for either four-wire or two-wire circuits, if the circulating energies are large, they will have an adverse effect on the ability of two people to carry on a conversation over a telephone circuit. Not only will the transmission received by the listener be adversely affected, but the talker will be considerably distracted, particularly when the time of the transmission over the circuit is so long that he hears a distinct echo of his words.

Experiments have shown that the effects of the echoes both on the listener and talker become more serious as their time lag is increased. This means that, as telephone circuits are made longer it is necessary either to improve balances or to design the telephone circuits so that the velocity of propagation will be higher.

This necessity for making the velocity of propagation high on long circuits was one of the principal reasons which led to the selection of extra light loading for the longer circuits.

Fig. 5 shows very approximately how the effects of the echoes vary with the length of time by which they are delayed. One curve is given for the effect on the "talker," another for the effect on the "listener."

Both curves indicate, for various time lags, the comparative magnitudes of echoes which are small enough to be inappreciable when ordinary telephone conversations are carried on. The curve applying to the "listener" is referred to the direct power which he receives, while the curve for the "talker" is referred to the power which he puts into the circuit.

In Fig. 4 showing the condition existing in a two-wire circuit, the comparative magnitudes of the power in each echo are indicated, a typical condition of the lines being assumed. For the listener the echo power is expressed as a percentage of the directly transmitted power which he receives. In the case of the talker, it is expressed as a percentage of the power which he puts into the circuit.

In addition to the comparative amounts of power in each echo, "weighted" magnitudes are indicated. The "weighted" figures take account of the fact that the effects of a given amount of echo become more serious as the time lag is increased as indicated by the curves in Fig. 5. Referring to Fig 4, it will be noted that the "weighted" magnitudes of the power in the echoes are largest for the long paths. In general, this condition exists in the case of the majority of long two-wire repeatered circuits in cable.

In order to compare the behavior of a four-wire circuit with a two-wire circuit, consider again Figs. 3 and 4. It will be observed that in Fig. 4, showing the two-wire circuit, there is one echo received by the talker which travels from one end of the circuit to the other. Referring to Fig. 3 showing a four-wire circuit, it will be seen that this echo corresponds to the one

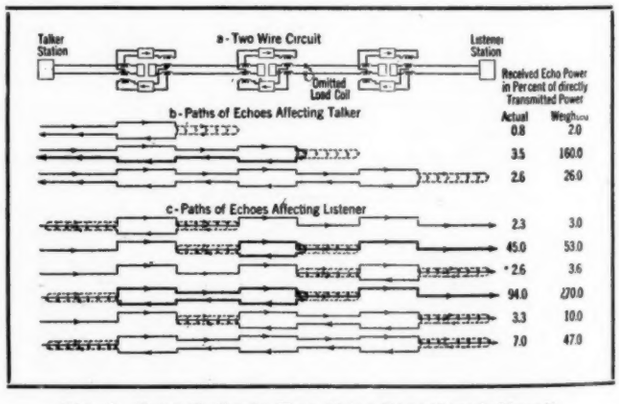


Fig. 4. Echo Paths in Two-Wire Repeatered Circuit.

labelled "1st echo, talker." Similarly for the echoes affecting the listener, the echo whose path is longest in the two-wire circuit corresponds to a similar echo in the four-wire circuit.

Since many additional echo paths are present in the two-wire circuit, it is evident that, other things being equal, the over-all transmission result obtainable

from the two-wire circuit cannot be made as good as that obtainable from the four-wire circuit.

In a two-wire circuit it is, of course, obvious that any defect in the lines which will cause a large irregularity will result in a considerable impairment of the circuit. Fig. 6 shows the effect of omitting a loading coil at an intermediate point in a circuit, the conditions in this circuit being assumed to be the same as those in Fig. 4 with the exception of the omitted loading coil.

The omitted loading coil introduces a large impedance irregularity which causes certain of the echoes to be made much greater in comparative magnitude as indicated. In order to reduce the echoes in the circuit with the omitted loading coil sufficiently to make the circuit satisfactory for telephone use, it is necessary to reduce the repeater gains.

In this particular case it is necessary to lower the total gain about four miles, which increases the over-all transmission equivalent of the circuit from about 10 miles for the normal condition to about 14 miles for the condition with the omitted loading coil.

Before leaving the subject of "echoes" it is believed that it will be of interest to point out some of the important characteristics of two-way repeatered circuits which result from these effects:

1. The minimum permissible net equivalent (total loss minus total repeater gain in one direction) of a four-wire circuit of a given length depends only on the velocity of propagation and the balance conditions at the terminals of the circuit. When conditions are such that the balance conditions cannot be improved, increasing the velocity of propagation will enable a lower net equivalent to be obtained.

2. In the case of a two-wire circuit with reasonably smooth lines, the exact location of the repeaters and the gains at which individual repeaters are worked have little effect on the over-all result so far as echo effects are concerned.

This follows from the fact that the echo paths from end to end of such a circuit are usually of more importance than the shorter echo paths. Evidently, moving the individual repeaters about or alternating their gains has no effect on the longest paths, provided the total gain in each direction is kept constant.

3. In the case of a two-wire circuit of a given length, the velocity of propagation and smoothness of the lines are of most importance in limiting the possible net equivalent, the line attenuation being of secondary importance.

For example, in the case of transcontinental (New York-San Francisco) open-wire line, the original circuit was loaded. (Although this paper deals particularly with repeaters on cable circuits this example was selected because it illustrates this point so well.) The velocity of propagation was such that voice currents required about 0.07 second to travel from one end of the circuit to the other. The total line equivalent was equal to about 56 miles of standard cable. By applying repeaters to this circuit it was possible to obtain a working net equivalent of about 21 miles.

The unloading of the circuit increased the velocity so that the time of transmission was reduced to 0.02 second, about 0.3 of the time required when the circuit was loaded. The attenuation was increased so that the total line equivalent without repeaters was equal to about 120 miles of standard cable, a little more than twice the equivalent of the loaded circuit.

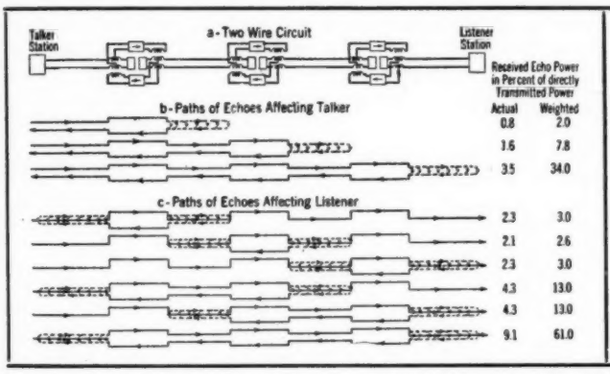
By applying repeaters of an improved type to this circuit so as to keep the quality good in spite of the increased attenuation and correspondingly increased gain required, it was possible to obtain a working equivalent of only 12 miles of standard cable as compared to the original figure of 21 miles. This means that with the same amount of speech power applied at one end, the power received over the non-loaded circuit is seven times as large as that formerly received over the loaded circuit. A material improvement in the telephone quality was also effected by the unloading of the circuit.

The example of the transcontinental line, above, may well bring up the question as to why it is that cable circuits are loaded. This is done for two reasons:

In the first place, it is in general cheaper to load cables than it is to make up the increased attenuation by means of more repeaters. In the second place, the loading lessens the amount of distortion introduced by the cable circuits. In the case of the open-wire circuits, their series inductance is sufficient to keep the distortion small.

Owing to the fact that the weight of loading applied to the longest cable circuits is very light, the attenuation of such circuits is very great. A four-wire x. l. l. No. 19 gage circuit 1,000 miles long has the enormous line equivalent of 500 miles of standard cable.

The total power amplification applied to this circuit by the repeaters exceeds 10^{47}. This amount of amplification is more than enough to talk half-way around the world at the equator using non-loaded



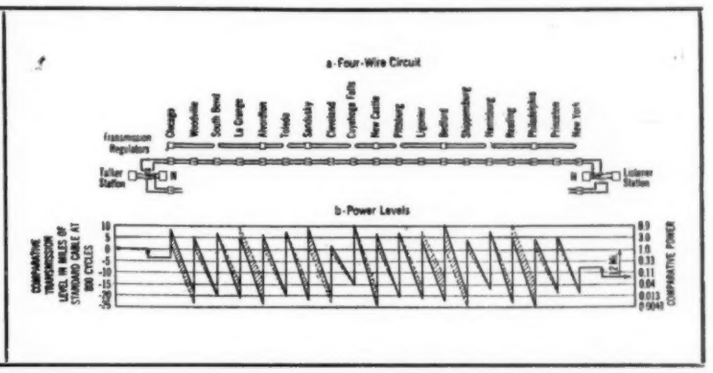


Fig. 6. Echo Paths in Two-Wire Repeatered Circuit With Omitted Loading Coil.—Fig. 7. Power Levels in New York-Chicago Extra Light Loaded Four-Wire Circuit.

No. 8 Birmingham wire gage open wire commonly employed for handling very long distance business (No. 8 B. w. g. copper weighs 435 pounds per wire mile, or 120 kilograms per kilometer).

In order to obtain an idea of how enormous this amplification is, assume that no repeaters were employed and an attempt were made to apply enough power at one end of the circuit to enable the normal amount of speech power to be received at the distant end. The power applied at the sending end would then have to be about 50 quadrillion times as great as the total power which it is estimated is radiated by the sun.

While the total amount of power amplification is very great, the amount of amplification put in at any one point is, of course, limited. The maximum amount of power at a repeater point is limited partly by the capacity of the vacuum tubes and partly by the power carrying capacity of the telephone circuit, including the loading coils. (By power carrying capacity is here meant the ability to carry voice waves without serious distortion.) It is also necessary to limit this power to avoid serious crosstalk into other circuits.

In addition to these limitations on the maximum power, it is necessary to insure that the power at any point in a circuit does not become too small. Otherwise

the normal voice power will not be sufficiently large as compared to the power of crosstalk from other circuits. It is, furthermore, evident that the ratio of power from extraneous sources, such as paralleling telegraphic circuits and power supply circuits, to the voice power should be as small as practicable in order to keep the circuits free from noise.

Fig. 7 will give an idea of how the telephone power attenuates and is amplified in a long circuit. The circuit shown is similar to those which it is proposed to employ between New York and Chicago, *i. e.*, it is a four-wire x.l.l. No. 19 wire circuit largely in aerial cable, equipped with automatic means for compensating for the changes in attenuation caused by the effects of varying temperatures on the resistance of the conductors. (These automatic devices are described in a later section of this paper).

For simplicity, the power levels for transmission in one direction only are shown. The solid lines show the power levels when the temperature is a maximum so that the attenuations are greatest while the dotted lines show the levels when the temperature is a minimum and the losses are, therefore, also a minimum. The shaded areas between the lines represent the changes which take place during the course of a year.

When the requirement is introduced that transmission must take place in both directions, it is found that at the points in the circuits going in one direction where the power is a maximum, the power going in the opposite direction in other circuits is a minimum. This represents a very bad condition for crosstalk from one four-wire circuit into another.

In order to overcome this the conductors carrying strong voice power are kept electrically separated or shielded from those carrying weak power as indicated schematically in Fig. 8. The conductors which carry strong voice power are shown heavy, while those carrying weak power are shown light.

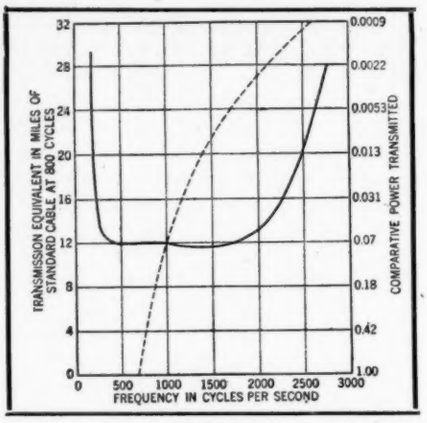


Fig. 9. Transmission-Frequency Characteristic of Long Extra Light Loaded Four-Wire Circuit.

In the cable proper the separation is effected by grouping the conductors in two bunches, one for transmission in one direction, the other for transmission in the opposite direction, taking care that these two bunches of conductors are separated electrically as far as possible. In the loading coil pots the coils employed on the circuits for transmission in the two directions are similarly kept separated. In the offices the separation is effected by arranging the repeaters and other apparatus as shown in the figure.

It will be observed that no special separation is shown between the repeaters transmitting in the two directions, since to keep the conductors carrying weak power separated from those carrying strong power, it is merely necessary to keep the apparatus and cabling connected to the inputs of the repeaters separated from the apparatus and the cabling connected to the repeater outputs.

Steady State Distortion.

The possible sources of distortion may be divided broadly into (1) repeaters and auxiliary apparatus and (2) the lines.

With reference to the distortion introduced by the repeaters, the vacuum tube is fortunately very nearly perfect, at least insofar as concerns practical telephony.

At one time, for purposes of test, a circuit was set up containing 32 vacuum tubes in tandem. On this circuit the distortion was so small that when listening to ordinary conversation it was difficult to detect any difference in the quality of transmission before and after traversing the 32 vacuum tubes.

It is beyond the limits of this paper to enter into the problems of design which were encountered in the development of the repeater circuits.

Considering next the lines, it is necessary to make the loading very regular so that balance difficulties will not cause an undue amount of trouble on two-wire circuits. Regularity of the loading is also essential in order to avoid irregular transmission of different frequencies.

In order to secure this regularity of loading, it is necessary that the spacing between loading points be made very uniform and that the cable be manufactured so that the electrostatic capacity of its circuits be held within close limits. The loading coils themselves must be closely alike in their electrical properties and furthermore, the coils must be stable, *i. e.* these electrical properties must not change appreciably due to the passage of voice currents or other currents required for cable operation through them. Next, it is necessary to design the repeaters and associated apparatus used on the longer circuits, particularly the four-wire circuits, so as to put in different amounts of gain at different frequencies, thereby making the overall transmission at different frequencies approximately constant in spite of the fact that the loss introduced by the cable circuits at different frequencies is not constant.

Fig. 9 shows the overall or net transmission equivalent plotted against frequency for an x. l. l. four-wire circuit 1,080 miles long (1,750 kilometers) which was set up for the purposes of test. The heavy line in this figure shows the overall result which was actually obtained with

(*Please turn to page* 27.)

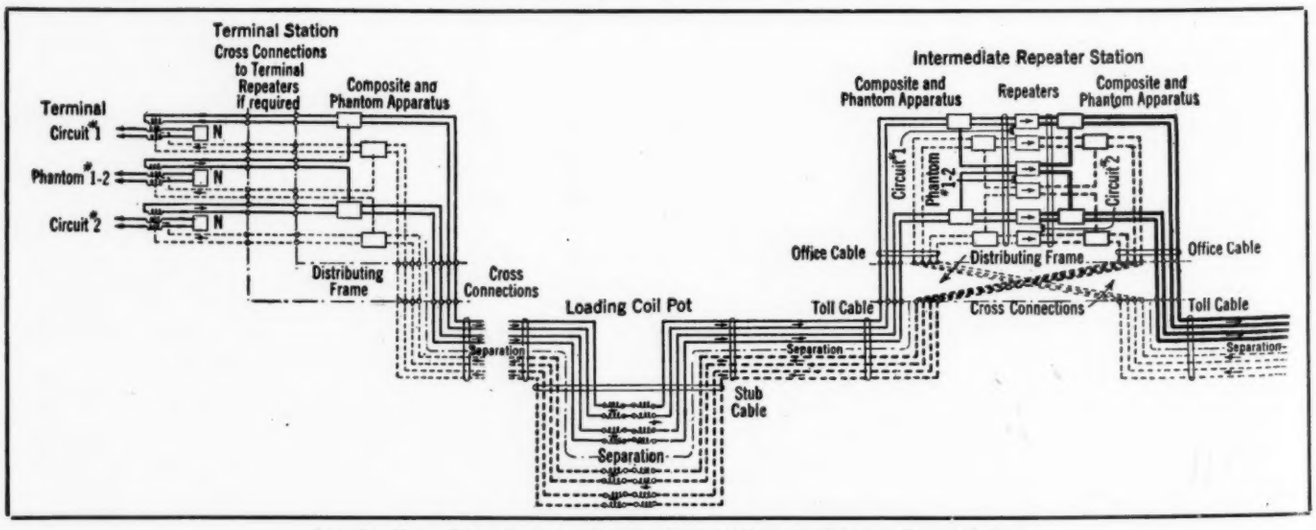


Fig. 8. Four-Wire System—Segregation Method to Reduce Cross-Talk.

North Dakota Men Hold Convention

Telephone Men Have Annual Meeting at Grand Forks—Variety of Interesting and Helpful Talks on Topics of Current Import—Members Urged to Work for Benefit of Each Other—"Public Program" One of the Features

The annual meeting of the North Dakota Telephone Association was held at Grand Forks, March 13, 14 and 15. The program was varied and many interesting and informative addresses were made. The operators' traffic conference was one of the interesting and valuable sections of the meeting.

M. M. Borman, of Abercrombie, was re-elected president at the Thursday morning's session. H. A. Brown, of Cooperstown, was re-elected vice-president, and F. R. Irons, of Starkweather, was named secretary-treasurer, succeeding A. J. McInnes, of Valley City.

Members of the executive board named include M. B. Richardson, Fargo; P. J. Smith, Beach, and A. T. Nicklawsky, Hillsboro.

The convention opened Tuesday afternoon at the Commercial Club. Mayor Henry O'Keefe gave an address of welcome in behalf of the city of Grand Forks, pointing out that as a public utility, the progress of the telephone as an indispensable aid to modern civilization is watched with interest by the people of today.

Response to Mayor O'Keefe's address was made by H. W. Wilson, of New Rockford, a member of the executive committee of the association.

M. M. Borman, of Abercombie, president of the association, made a short talk in which he lauded the interest of the members of the North Dakota association in the progress shown by the telephone systems of the state in keeping up with the demand for service.

M. M. Borman, of Abercrombie, Re-elected President, Is Strong for Co-operation Among the Members—and He Gets It.

H. A. Brown, of Cooperstown, reported on the work of the taxation committee and Secretary A. J. McInnes, of Valley City, presented an extensive report for the past year in which he pointed out the work of the legislative committee and gave a resume of the work for the past year.

Julius F. Bacon, general manager of the Grand Forks Herald, delivered an address on "As Others See Us." He pointed out that the telephone is especially valuable as a time-saver in present-day business and eliminates the need for considerable travel and the time involved that would otherwise be necessary.

In giving what he termed the standpoint of telephone service as seen by the public, he emphasized the need for speed and accuracy on the part of the telephone service in the present day, adding that the service had kept pace with this need.

Radio vs. Telephone.

The telephone will never be displaced by the radio telephone, Jay Houghtaling, of St. Paul, declared during the course of an address given by him on "Radio Telephony and its Operation Commercially."

In explaining his assertion, Mr. Houghtaling said that there is a certain amount of business and even friendly conversation that is carried on over the telephone which could not possibly be sent through the air to be heard promiscuously, that the radio is all right in the capacity for which it is now used—for broadcasting programs, stock and market prices, etc.—but, for the carrying on of business transactions, the telephone is the logical means of transmission.

Following the talk by Mr. Houghtaling, a round-table discussion, lasting nearly an hour was conducted in which J. J. Lamb, manager of the Valley Radio of Grand Forks, and C. R. Sargent of the Western Electric Co., of Minneapolis, took part with several others.

Public Program.

During a public program at the Guild Hall on Tuesday night, given by telephone employes, Miss Doris Graham of the traffic department of the Grand Forks exchange gave a demonstration of the use of the telephone. A miniature switchboard was used by Miss Graham, in illustrating her talk. Among other things, it was shown that the irate patron of the telephone service, who wants to attract the operator's attention by rapidly flipping the receiver hook up and down is bothering the operator not at all, because only a slow flipping of the receiver causes a change in the operator's light on the switchboard.

With the aid of the miniature switchboard, Miss Graham showed how calls are received and dealt with.

Demonstrations of proper and improper use of the telephone were made and, in conjunction with a 45-minute talk, Miss Mildred Cadwell, Leigh Fuller and Carl Paine demonstrated what happens when a patron calls from memory, giving the wrong number, when he is late inanswering a call and when the line is "busy."

H. A. Brown, of Cooperstown, Will Again Act as Vice-President.—He Did Some Good Work on the Legislative Committee.

Other numbers on the program included a reel of comic motion pictures and three reels of film showing the various phases of laying the submarine cable from Key West to Havana. There were also a number of musical selections.

A discussion and demonstration of first aid to accident victims, led by Oscar Bondelid, of Grand Forks, and a thorough discussion of collection methods, in which H. A. Brown of Cooperstown and R. H. Morris of Bismarck, chief engineer for the North Dakota Railroad Commission, were the leading spirits, formed the program for Wednesday morning.

Mr. Brown, Mr. Morris and others who participated in the discussion on collection methods and business affairs, agreed that telephone companies should operate on a strictly cash basis.

Mr. Brown told of some of the business methods employed by the company operating at Cooperstown, giving suggestions

that could be adapted elsewhere. A very general discussion of this topic, which was further taken up by Mr. Morris, was continued in the afternoon, after the noon recess.

Mr. Bondelid gave a comprehensive paper, covering the topic assigned to him from a number of angles that made it valuable. In connection with it, he gave three demonstrations, showing the proper methods of first aid to be adopted in the case of broken bones, severed arteries, burns, and artificial resuscitation in the case of drowning, electrocution, etc. The demonstrations were followed by a general discussion on the subject.

Radio telephony and its development was exhaustively described by Prof. Beyer, assistant professor of physics at the University of North Dakota. He used blackboard drawings to show the construction of various parts of the radio receiving set and explained the principle of a set throughout.

In speaking of rates and regulations governing telephone companies in North Dakota, R. H. Morris explained that all such questions had to be settled through the state railroad commission as the laws of the state did not govern this matter.

He said that every case of this nature was handled on its own merits and that the commission did everything in its power to make an equitable decision whenever a case is presented.

Thomas Phalen, superintendent of traffic for the Dakota Central Telephone Co. at Aberdeen, S. D., read a paper on "Public Relations With Subscribers."

Mr. Phalen pointed out that nothing but a cordial relationship between the company and its subscribers will work for the best interests of both. He showed the advisability of taking the public into its confidence by the company on its problems and explaining any point of service to the subscribers that will prove of benefit to all concerned.

"Other Line Charge."

A round table discussion was held at the close of the afternoon's program on "Other Line Charge." There are cases in the state, it was pointed out, where a group of people get together and establish a private line which, although it does not belong to any of the companies of the state, yet is connected with the nearest company exchange through some agreement. A practice is in use among these exchanges wherein an extra charge of 10 or 15 cents is made for the privilege of connecting in for a call over long distance wires.

The Traffic Conference.

The point that received a great deal of attention at the traffic conference was the importance of the toll operator ticketing long distance calls with the greatest possible amount of precision. Tests were made at all sessions, in which those taking the instruction were asked to mark sample printed long distance talks, showing where in the talk, the toll ticket should be punched, for the start and the end of the period for which a charge is made.

The point was taken at the meeting that, although the charge is smaller, the companies would rather handle station-to-station calls than calls for individuals, as faster service can be maintained in this way.

The long distance patron often feels, it was explained, that the "report charge" which is made where a party is not secured, is unreasonable. It was pointed out, however, that there is just as much work on the part of the operators in making the necessary connections where the party is not secured, as in cases where he answers the call.

Traffic sessions which were held in connection with the convention, were in charge of R. C. Bolsinger, of Fargo, division traffic supervisor of the Northwestern Bell Telephone Co.

On Wednesday evening a banquet for the convention visitors and invited guests was held in the Dacotah hotel, followed by a dance.

Speakers at the banquet were: Martin Colton, W. W. Blain, C. E. Ladd, Philip R. Bangs, Paul Bunce and Richard Wenzel, all of Grand Forks; R. H. Morris, chief engineer of the North Dakota Railroad Commission of Bismarck; Thomas Phalen, of the Dakota Telephone Co., of Aberdeen; J. A. Houghtaling of the Northwest Equipment Co., of St. Paul; Mr. Sargent, of Minneapolis; Ray Palmer of the Monarch Telephone Mfg. Co., of Chicago; S. G. Harris of Page & Hill Co., of Minneapolis. Charles E. Hall of Omaha acted as toastmaster and introduced the speakers.

Speakers on the Thursday morning's program were R. H. Morris, chief engineer for the North Dakota Railroad Commission; Philip Bangs, of Grand Forks; A. T. Nicklawsky, of Hillsboro, manager of the Traill County Telephone Co.; Thomas Phalen, secretary of the South Dakota Telephone Association, and J. P. Smith, of Beach, manager of the Golden Valley Telephone Co.

Mr. Morris spoke on the rules and regulations existing in the state, governing the construction of telephone lines along the highways. He said that these rules would be adhered to as strictly as possible.

In a discussion of legislation affecting telephone companies Mr. Bangs referred to the former control of public utilities through state legislation and traced the history of the matter to the present local community control of public utilities. The latter, Mr. Bangs said, is in the main effective and satisfactory.

Mr. Nicklawsky spoke on the construction of rural and toll lines for small companies, saying that the principles of construction for the small concern should be the same as that for the larger company, in order to provide the most effective maintenance and service.

Co-operation among members and officers is the outstanding feature of making a telephone association of benefit to its members. Mr. Phalen told the convention visitors. He urged support of the association officers by the general membership, if the association is to function properly. A system of accounting that is a help in the saving of labor, time, etc., was described by Mr. Smith.

Florida Association Looks Forward to Its Best Convention.

A large attendance of both members of the association and of visitors and manufacturers of telephone equipment from outside the state is assured for the annual convention of the Florida Telephone Association by the reservations that have already been made for space and rooms. The meeting will be held March 27 and 28, at the Roberts Hotel in Miami.

The purpose of the convention is to bring together the men of the telephone industry of Florida, in order that they may discuss the problems that confront them in the rapidly increasing demands for service, as required to meet the growth and development of the state.

An excellent program has been prepared with speakers of national reputation in the telephone field, including President MacKinnon of the U. S. Independent Telephone Association and Vice-President Reid of the Southern Bell Telephone & Telegraph Co.

Work Progressing on Chicago-Boston A. T. & T. Cable.

Some amazing figures in regard to toll line cable construction costs were presented in an article under the same head as the one above this item, relative to the Chicago-Boston A. T. & T. cable. The item appeared in TELEPHONY of March 3, on page 16.

To anyone familiar with the cost of cable and line construction work, the figures are startling and palpably in error.

It was stated that the cable line "is being constructed at a cost of $200,000 a mile," when, of course, the figures should be very much smaller—the correct figure being $20,000 a mile.

It was also said that "The line from Pittsburgh to Youngstown, now about completed, will cost $125,000,000". This should have read $1,250,000.

Gainesboro Company to Buy Additional Lines in Tennessee.

An announcement has been made that the Gainesboro Telephone Co., whose headquarters are at Cookeville, Tenn., has leased the Cumberland Telephone & Telegraph Co.'s lines in Smith county.

This deal has been contemplated since the exchange at Carthage burned about a year ago. The Gainesboro Telephone Co. bought the Home Telephone Co. exchange and lines.

Responsibility of Line Operator

Her Duty to the Company, the Patron, and the Other Operators—Six Points Which Will Help Her to Increase Her Efficiency—Some Modern Methods—Paper Presented at Annual Convention of the Pennsylvania Association

By Miss Helen Ardary

Chief Operator, Huntingdon & Clearfield Telephone Co., Clearfield, Penna.

When a line operator enters the operating room she must feel that the company which employs her has given to her, as its representative, an important responsibility, in that she is in charge of its toll business for the time she is at the switchboard. And to handle the company's business in an efficient manner she must:

First: Concentrate her mind and efforts to expedite all business entering, outgoing or passing through the central over the lines in her charge.

Second: Be thoroughly familiar with the several routings of all circuits in her charge.

Third: Ascertain if all circuits are clear. In case any go bad while operating, she must immediately report them to the supervisor, the wire chief, or whoever may be in charge at the time.

Fourth: She must not forget her smiling voice, whether to a subscriber or other line operators.

Fifth: Be familiar with operating rules and practices, and follow the instructions in handling the several classes of business that are offered.

Sixth: Realize her dependability. This matter is all-important. The company depends on her to answer calls promptly; make connections with the least possible delay; record, monitor and clear circuits promptly; assist other line operators in every way she can; report cut-offs, poor transmission, line trouble, key or cord trouble, etc.

However, there are certain important responsibilities and duties which are common to all offices, large and small, and which should receive careful thought, in order to have the work of a toll center handled promptly, courteously and with a minimum waste of valuable operator's time and circuit time.

We will, for the sake of brevity, group a line operator's responsibilities under three main divisions:

(a) Responsibilities and duties to the subscriber.

(b) Responsibilities and duties to other operators.

(c) Responsibilities and duties to the telephone company.

Consider first our subscriber, in relation to the line operator's work. It is by no means a small part that the line operator plays. She is primarily responsible to the subscriber for courteous, prompt and accurate service.

Of these, courtesy ranks very high, for no matter how prompt and accurate the service may be, if it is accompanied by a discourteous act on the part of the line operator, our subscriber is very apt to feel that service we are rendering is not up to the high standard we are striving for.

A line operator must always remember that she is *the telephone company* in all of her dealings with her subscriber. I like to think of a line operator as being the "general manager" of the position she occupies while performing her work. The operator at this position should have her work well organized. She should know where to find her work, also the relative stage of completion of all of her calls, and furthermore keep it moving with the minimum of effort on her part. And by doing this she knows that almost automatically she will render a prompt and uniform speed of service over each circuit group.

A line operator, above all, must be accurate in everything she does. Consider the important feature of timing a long distance call. We surely do not want to overtime a connection and hence overcharge a subscriber for the service rendered. However, it is just as important that we do not undertime a connection. It is almost universally true that a subscriber will pay for the service if a connection runs into overtime, provided the service has been prompt and courteous.

Line Operator and Other Operators.

Consider next a line operator's duties and responsibilities to other operators. It is obvious that if service is to be given accurately, quickly and economically, all of the employes who may be required to participate in the establishment of a long distance connection must work in complete harmony and with full understanding of their respective duties and responsibilities.

To accomplish this purpose, instructions for toll operating employes, which have been found by experience to render the most satisfactory service to the company's patrons and to secure the most efficient use of the company's plant, have been developed.

In the application of these instructions it is of the utmost importance that a pleasant tone of voice and a courteous manner be exercised in dealing with other employes; friendly, courteous coöperation with operators in her own office and other offices, should be the watchword of every line operator, for this alone will smooth out the many difficulties, create good feeling, and make her work a source of pleasure.

When we consider a line operator's duties to her company, we find that she is responsible for conducting her work in such a way as to insure the least waste of her own efforts, or switchboard equipment, and of toll circuit time. And furthermore she must complete as much of the offered business as possible.

Line Operator's Duty to Her Company.

The time that the toll circuits are used in attempting to complete calls should be kept as short as possible, consistent with accuracy and thoroughness. Similarly, the time that a line operator works on a call should be kept at the minimum consistent with the proper effort to complete the call without making another attempt.

One of the chief ways a line operator can save time is to work on only *one* call, over *one* circuit, at *one* time. It is not at all unusual to see a line operator working over two or more circuits at one time. The argument advanced in defense of this method is that she can keep the business moving faster in this way. However, our experience has shown us that the *"one* circuit at *one* time" method moves the business just as fast, if not faster, and does it with considerably less circuit time.

There are three major calls that line operators are called upon every minute of the day to handle. They are: Incoming or "Received" calls; outgoing or "Sent" calls; and switching or "Through" calls.

Incoming or "Received" Calls.

Where does the line operator's responsibility begin and where does it end on an incoming message? It begins at the line signal, which she must answer promptly by plugging in on the jack corresponding to the line. She must always answer by saying "This is ...." giving the name of her central in a clear, distinct voice. Therefore, she will expect the operator at the other end to reply in like manner by giving the name of her central, after which to proceed with the call, naming the class of service desired.

Upon receiving full information, she signals the party asked for at the address or number given, and, if that party responds, she makes the connection and notifies the calling operator, using the correct code. Of course, she must monitor the call until the parties are talking and then get off the line. At the end of the talking period she must continue supervising until the conversation ceases, at which time disconnections are made and her responsibility ceases.

In case the party called for is not in, she must try to locate him, giving full information to the calling operator. Special attention is given to "D. A.'s" (as they are a total loss) by calling the wire chief to ascertain whether the line is "O. D." If "O. D.", it is her duty to refer the matter to the supervisor who will try to locate the party elsewhere.

Outgoing or "Sent" Calls.

As a toll line operator, she receives the ticket of an originating or "Sent" call through the recording operator or the supervisor, although in smaller exchanges the toll line operator is also the recording operator. Her first duty is to examine the ticket thoroughly, thereby getting an imprint on her mind as to all its details.

Her next step is to pick out the most direct route known as "Route Number One." If the call is to be passed through one or more switching stations, she will say to the first switching operator. "This is ....; let me have a line to .....", giving the name of the central which is the destination of the call, and if through another switching station, the words are repeated.

On arriving at the destination, she repeats the name of her central and (under the old rules) says, "A ticket", or, where no "In" tickets are recorded, tells the operator who is wanted, giving the telephone number, name or address. In giving this call, the details depend on the class of service desired by the subscriber.

After the connection is established the ticket is timed, and it is her duty to monitor the call in periods of one-half minute each, which can easily be done by simply throwing the cam on the cords connecting the parties.

Her responsibility is doubled after connection is made, because a line may go bad at any time during the conversation and I believe it is better to personally detect it before her attention is called to the fact by the patron. If, at the end of the standard talking period, the parties are still talking, it is her duty to "break in" and in a low but distinct tone of voice advise the parties that their time has expired, after which strict supervision must be maintained until conversation ceases and ticket timed accordingly and filed.

In case of storm trouble or some break in the circuits, all lines being "out", the supervisor consults with the wire chief and ascertains the duration of the "O. D.", then the operator must inform all patrons that "Call will be taken subject to 30 minutes' delay", or the time set by the wire chief as to the time he expects the lines to be O. K. But she must in all cases, when any delay occurs, advise the patron as to the reason therefor.

Through or "Switching" Calls.

The line operator should feel more of a responsibility on "switching" calls than on either "Sent" or "Received" messages.

She should feel that she is the guiding hand to both the send and receiving operator, and she must be sure that the destination is properly given, for we all know that operators on the smaller exchanges try to build up their own circuits, which in itself is all wrong, as they are not familiar with the standard routings, and they must be handled in a diplomatic manner so they won't take offense at being corrected.

She must not only set up the through circuit, but must see that the next switching station answers, or, if her circuit terminates in the destined point, that circuits are clear and transmission good.

At this point her responsibility becomes greater, as she must see that under no circumstances are the connecting cords disturbed; also, she must closely supervise at short intervals to see that the two terminal exchanges are kept in uninterrupted communication. This is one of the most important duties, as the two centrals are wholly dependent upon the continuity of the circuits through any central on giving service between subscribers at distant points.

If the proper supervision is given and circuits restored to normal conditions promptly, the company stands to lose no revenue through reported "N. C.'s" or "wait a minute", which answer is the "bugaboo" of any alert, snappy, aggressive, alive-to-the-company's-interest operator.

From the company's standpoint, it is the line operator's job to complete calls. A telephone company is not in business for the purpose of giving information as to the whereabouts of various persons, or to report on the condition of the plant, any more than a railroad is in business to post notices explaining why trains are not running or delayed. The railroad's business is to transport passengers and freight, and the telephone company's business is to establish telephone connections between persons in different cities; anything less than that is unsatisfactory to the public and to the company alike.

In conclusion, I believe that if all operators, both local and toll, when they enter the operating room, would accept and shoulder the responsibility placed on them by their companies, and forget their social duties while on duty and conduct themselves as any other business woman would in their several lines of endeavor, better results would be obtained. But it cannot be done if the operators insist on bringing their social duties with them.

Let us resolve that we will not discuss any matters other than our duties while in the operating room, and when the rest period comes, let us also resolve not to discuss business, but our social activities. Don't you think that if we do this, our rest period will be a real one, and will fit us to go back to our operating with more vim and pleasure?

BRIDGE WORK

By Miss Anne Barnes

Traveling Chief Operator, Iowa Independent Telephone Association, Des Moines, Iowa

"Oh dear me!" groaned Mollie Leaner, in the rest-room. "My dentist says that I must have some bridge work done, and that he will have to use two perfectly good teeth to fasten the bridge on to."

"Well, Mollie, I thought that we had heard the last of your troubles after you had your appendix and tonsils removed. Why, I have given those same organs of mine five more years of work than you have given yours, and I expect to keep them busy for some time to come."

"Oh, well, I'm not the workhorse type, Grace Goodspeed," flared Mollie, as she hurriedly left the room.

That last statement of Mollie's was quite true. She was not the workhorse type—nor any other type which might have the word "work" hitched to it. She had sat between Grace and me at the old Crystal City board for five years, and was usually more of a hindrance than a help. She no sooner got her board full of connections than she had to run to the booth to talk to her mother, brother, friend, or the doctor.

Mollie was popular with a number of people who were too lazy to read the paper or look up a number.

"Just a moment, Mrs. Waddle," she would say. "Girls! Poor Mrs. Waddle—the dear, old soul—has left her glasses upstairs again. What's the White Way grocery? Quick!"

"That little Mollie Leaner is surely accommodating," says Mrs. Waddle at club. "Those other girls just snip you right off short. They say, 'Refer to your directory, please.' If they knew all of the numbers like Mollie does, they wouldn't be asking the subscribers to do what they are paid for."

"Caroline, at least I am able to define Mollie Leaner," Grace said to me as we sat at lunch together the day that Mollie told us about her teeth. "She is the bridge work; and *we*—you and I—well, you know what she said about those two perfectly good teeth."

Financial Statements and Reports

Tri-State Company, of St. Paul, Minn., Had a Good Year During 1922, Reports Public Relations Good—Illinois Bell Spent Large Sum on Improvements—Nebraska Company Sustained a Loss—Reports of Other Companies

Last Year Was a Good One for Tri-State Company of St. Paul.

Last year, the Tri-State Telephone & Telegraph Co., of St. Paul, Minn., paid the largest return on common stock that it has paid in six years—8 per cent. The usual 6 per cent dividend was paid on the preferred stock, but this good dividend on the common was made possible through economies effected in all departments.

The gross earnings during 1922 amounting to about $4,500,000; maintenance, traffic, commercial and other expenses took some $2,300,000 of this, and taxes took a good slice—$219,000, or 4.88 per cent of the total receipts.

The condensed income statement for the year ending December 31 follows:

Gross earnings from all sources		$4,481,027
Maintenance, traffic, commercial, general and other expenses	$2,339,545	
Federal, state and municipal taxes	218,689	
Reserve for depreciation of plant and equipment	798,597	3,356,831
Net earnings prior to interest		$1,124,196
Interest paid		433,234
Net earnings after interest charges		$690,972

To the net earnings as shown there will be added $212,163 to correct excess interest charges previously made on the amount estimated to be due for purchased property while it was being appraised.

In his letter accompanying the dividend checks, President G. W. Robinson makes this reference to the employe problem:

"The telephone industry gives employment to a large force of skilled men and women, and a small turnover is essential to an efficient public service.

"Through the stabilizing of wages and improved working conditions the turnover for the past year has been comparatively small and the management has been enabled to better use its judgment in the selection of employes.

While the year's net gain in stations was approximately 3,000 the average number of employes remained practically the same—an evidence of greater individual efficiency per employe.

For the year the amount paid for labor aggregated $2,116,820 or 47 per cent of the total receipts for service rendered."

Regarding the maintenance and depreciation accounts, which aggregated $1,436,757, or 32 per cent of the gross receipts, Mr. Robinson points out that a high standard of property upkeep is essential, not only to the giving of proper service, but for the protection of the invested capital.

The following condensed balance sheet shows that the capitalization of the Tri-State company is properly balanced as between preferred and common stocks and long term bonds; that the current assets of the corporation are approximately three times its current and accrued liabilities; and that it has available sufficient cash to liquidate all current indebtedness.

CONDENSED BALANCE SHEET.

Assets.

Plant, equipment and supplies	$16,815,334
Stock of system corporations	197,890
Due from subscribers, agents, etc.	252,365
Invested in marketable securities	423,602
Cash in banks	642,292
All other assets	82,848
	$18,414,331

Liabilities.

Common and preferred stocks	$10,118,580
Bonds (direct and assumed)	5,245,000
Accounts payable (including accrued taxes and interest not due)	527,265
Service billed in advance	27,249
Miscellaneous credits	8,378
Reserve for employes' benefit fund	50,000
Reserved for renewal of physical properties	1,805,630
Other reserves	6,141
Surplus and undivided profits	626,088
	$18,414,331

Included in the Tri-State funded debt is an outstanding bond issue of the Rochester Telephone Co. in the amount of $125,000. The Tri-State took over that company and consolidated the accounts. The Tri-State holdings of stock of the Rochester company were surrendered in part payment for the physical properties and all of these changes are reflected in the balance sheet.

President Robinson comments on the fact that the company is free from any important litigation at the present time, and that its public relations remain most satisfactory.

Operating and Financial Data of Northwestern Bell.

The annual report of the Northwestern Bell Telephone Co., which operates in the states of Iowa, North and South Dakota, Minnesota and Nebraska, shows that it added 15,064 telephones to the number in service, making a total of 492,023. Much of the increase was in extension telephones. The company expects to add 18,000 during 1923, and its budget calls for the investment of over four million dollars. The present book cost of the entire company is $76,225,000.

The company operates 457 exchanges in the five states, giving service to 51,600 farm telephones in addition to the 492,023 on its own lines. To operate the plant required an average of 9,234 employes, with a payroll averaging $875,000 a month or 10½ millions for the year.

Gross additions during the year represented nearly a million for central office equipment, a similar sum for exchange outside plant, and $660,000 for toll lines and wires. The company employs 4,036 exchange operators and 1,536 toll operators.

In the five states served by the company there are 1,572 other companies serving 869,881 stations.

Wisconsin Rural Telephone Company in Prosperous Condition.

The annual statement of the Platteville, Rewey & Ellenboro Telephone Co., of Platteville, for the year 1922, shows a net return on the investment of over 6 per cent.

The income statement accounts for revenues for the year amounting to $30,473; operating expense, $22,101; taxes $1,327, and miscellaneous charges to income $73, leaving a balance of $6,972 transferred to the credit of surplus.

The plant and equipment, cash on hand, notes receivable, due from subscribers, materials and supplies amounted to $110,252 December 31, 1922.

The company paid a dividend to stockholders recently and is in shape to distribute profits—the best indication of the fact that the company has been well managed.

The line will be extended this summer to cover southern and western portions of the county.

Illinois Bell Improvements Cost 17 Millions Last Year.

Net income of the Illinois Bell Telephone Co. increased approximately $700,000 in the last year, according to the company's annual report made public recently.

Operating revenue gained more than $2,000,000, but expenses also advanced approximately $1,275,000. Interest on the mortgage debt was cut more than $1,000,000.

During the year $17,190,694 was expended on construction, nearly one-third of the total telephone operating revenue. Improvements will cost about $17,400,000

Strowger Automatic, The Best Telephone Equipment That Money Can Buy

Why They Prefer Automatic

Many managers of automatic operating companies, although enthusiastic advocates of Strowger Automatic equipment, are often unable to express the reasons for their preference for Strowger equipment in definite terms. They know that there are so many valuable and essential features in a Strowger exchange that it is impossible to pick out any one and say, "This is the best."

But back in the mind of all those who know Strowger Automatic through actual use is a deep-seated pride in the knowledge that the equipment they use is the very best that money can buy; that the service they render their subscribers is the very best that modern telephony has to offer.

When the time comes for you to replace your present equipment with Strowger Automatic this satisfaction will be yours, too. Why not begin to learn the facts about the Strowger system ***now***—as applied to your own exchanges.

Automatic Electric Company

FACTORY AND GENERAL OFFICES: CHICAGO, ILLINOIS

BRANCH OFFICES IN ALL PRINCIPAL CITIES

ASSOCIATED COMPANIES

INTERNATIONAL TELEPHONE SALES AND ENGINEERING CORPORATION, New York

National Automatic Telephone Company, Ltd., London — Compagnie Francaise pour l'Exploitation des Procédés Thomson-Houston Paris

Automatic Telephone Mfg. Co., Ltd., Liverpool. — Automatic Telephones, Australasia, Ltd., Sydney

for this year, according to the company's building program.

Financial statements compare as follows:

Income Account.

	1922	1921
Tel. oper. rev....	$ 47,667,284	$ 44,469,882
Tel. oper. exp....	35,401,645	33,141,840
Net. tel. op. rev.	$ 12,265,638	$ 11,328,042
Net other op. rv.	2,295	3,699
Tot. net op. rev.	$ 12,267,934	$ 11,331,741
Deduct—		
Uncoll. op. rev.	171,825	136,827
Taxes assignable to oper..	3,967,434	3,620,604
Oper. income...	$ 8,128,674	$ 7,574,309
Non-op. rev.—net	500,218	274,810
Tot. gross inc..	$ 8,628,893	$ 7,849,119
Rent and miscel. deduc.	203,228	180,840
Int. on mort. debt	961,311	2,042,327
Other int.....	1,110,724	.....
Bal. net. inc...	$ 6,353,628	$ 5,625,951
Dividends	4,000,000	3,600,000
Amt. tran. to cred. of corp. surp...	$ 2,353,628	$ 2,025,951

Assets.

	1922	1921
Intangible cap...	$ 42,638	$ 54,469
Total plant.....	130,554,375	117,884,221
Gen. equipment..	2,222,749	1,907,303
Other perma. and long term inv..	339,770	201,276
Cash and deposits	1,509,975	908,565
Marketable sec...	4,356	1,334
Bills receivable...	32,312	16,393
Accts. receivable.	5,157,659	4,953,834
Mater. and supp.	793,603	762,368
Accr. inc. not due	4,681	4,217
Deferred debits..	458,260	445,995
Total assets...	$141,120,384	$127,139,974

Liabilities.

	1922	1921
Capital stock.....	$ 60,000,000	$ 50,000,000
Prm. on cap. stk.	2,911	2,911
Funded debt.....	34,884,179	35,087,179
Accts. payable...	2,754,294	4,860,970
Acc. liab. not due	4,114,610	4,860,970
Def. cred. items..	1,879,821	995,178
Res. for acc. dep.	33,522,899	29,512,750
Corp. surplus....	3,961,666	2,636,047
Total liabilities.	$141,120,384	$127,139,974

The net gain in the number of telephones last year was 45,387. At the close of the year the company's traffic reached a daily average of 4,500,000 calls, of which more than 3,000,000 were in Chicago.

In his report to stockholders, President W. R. Abbott points out the following:

"But little change has taken place during the last year in the matter of rates. An increase in rates was approved by the Illinois Commerce Commission, effective as of November 1, 1922, for the Galena exchange.

"In Chicago and other exchanges where the rates have been in controversy, hearings have been held, but no orders have been entered by the commissions. In certain cases which were before the courts, decisions have been handed down by the Supreme Court of Illinois remanding these cases to the commission for further action.

"During the year benefits were paid to 5,404 employes under the plan for employes' pensions, disability benefits and death benefits, totaling $444,245."

Bloomfield, Neb., Company Loses Nearly $1,700 in 11 Months.

The annual report of the Bloomfield Telephone Co., of Bloomfield, just filed with the Nebraska State Railway Commission, represents 11 months of operation under the schedule of rates fixed by a mass meeting of citizens, and also a loss of nearly $1,700 without a cent of return on the investment. A. C. Grace, who with J. H. Gessler, bought the property from the Union Telephone Co., of Wausa, a year ago, after a strike of patrons that lasted for months, has retired from the company, having sold his interest to other parties.

The state railway commission, after the Union had rebuilt the Bloomfield exchange, increased rates 23 per cent over pre-war figures. An organization of bankers, business men and farmers called a strike and, after months of turmoil and a complete cutting off of the town from telephone service, a truce was reached, whereby the company passed into the hands of Bloomfield men.

The annual report shows that the company received during the 11 months, from exchange revenues, $9,238.73; toll, $679.55, and miscellaneous, $954, a total of $10,-872.28. There were expended for current maintenance, $2,923.21, and depreciation of plant and equipment was estimated at $2,292.34, a total for these items of $5,225.55.

To this are added $1,674.45 for traffic expenses and $3,159.59 for commercial expense, a total of $10,068.59, leaving a net revenue of but $802.69. Against this are to be charged taxes of $569.06, interest of $1,813.30 and miscellaneous expenses of $107.80, a total of $2,490.16, leaving the loss for the 11 months, $1,687.47.

The company's report shows that the officers drew only $627 in salaries, although it is presumed the $1,800 each was supposed to draw, was cared for in part by the charges to maintenance, as both are experienced telephone men.

The company operates an exchange with 680 stations, which is larger than at the time the strike was called, and also switches 364 farmers' telephones.

The fixed investment of the company is $72,883, upon which nothing was earned. There is also working capital of $6,743 employed, which brings the total money involved in excess of $79,000. The principal items in the assets account are: Central station equipment, $15,954; city subscribers' stations, $5,802; farmer line subscribers' stations, $5,857; underground cable construction, $10,688, and farm pole lines, $17,252.

The property was secured by Grace and Gessler by the purchase of the $25,000 worth of stock and the giving of ten notes of $3,000 each, payable yearly over a period of ten years, upon which the interest charge is $1,800. The principal items in the liability column are: Common stock, $25,444; notes payable, $30,-327; depreciation reserve, $18,792.

Comparative Statement of Keystone (Pa.) Company Earnings.

With gross earnings about $6,000 higher during February of this year than during the preceding February, and a slight decrease in operating expenses and taxes, the Keystone Telephone Co., of Philadelphia, Pa., had net earnings $6,000 higher.

The balance available at the end of the month for dividends, surplus and reserve was some $3,500 more than for February of 1922, and the balance for the two months showed an increase of $9,000 over that for the first two months of last year.

The net earnings for January and February of this year were more than $13,000 in excess of those for the same period in 1921, but interest charges—which were $4,300 greater this year—brought the balance down somewhat.

	For Month Ended February 28, 1923	Year previous
Gross earnings	$143,827	$137,978
Operating expenses and taxes	79,796	80,052
Net earnings	$ 64,031	$ 57,926
Less interest charges	44,096	41,536
Balance available for dividends, surplus and reserve..	$ 19,935	$ 16,390

	For 2 Months Ended February 28, 1923	Year previous
Gross earnings	$287,938	$276,338
Operating expenses and taxes	161,738	163,270
Net earnings	$126,200	$113,068
Less interest charges	87,799	83,421
Balance available for dividends, surplus and reserve..	$ 38,401	$ 29,647

Pacific Bell Reports on Earnings in Bellingham, Wash.

The Pacific Telephone & Telegraph Co. will pay $1,567 to the city of Bellingham, Wash., for the franchise rights which enabled it to operate in Bellingham during 1922. This fact was indicated in the report of the company filed January 31 with city comptroller.

According to the terms of the agreement arrived at when the franchise was granted, the company is to pay the city 1 per cent of the gross earnings for each year, exclusive of the tolls for long distance service. The report shows that the gross earnings of the company for 1922 totalled $156,718.

What Is Your Company Doing?

Chats About Company Doings

By Stanley R. Edwards.

D. C. Phillips, president of the Marengo Telephone Co., Marengo, Iowa, chose the evening of St. Valentine's day to show his employes the fullness of his appreciation of their loyalty to him. A fine dinner, appropriate and in keeping with the spirit of the day, was served. This was followed by a short declaration of Mr. Phillips' kindly feeling towards his employes and the remainder of the evening was spent at the Strand, "Iowa's Finest Little Theatre."

The party was a result of loyalty displayed by the employes on last Thanksgiving day when the fire department was called to the Doose hotel.

One operator was on duty when the fire whistle sounded. Each operator started for the office so that if her services were required she should not be found missing. Some were at the football game, some were being entertained in the homes of friends and some were enjoying the day in their own homes, but with the loyalty to their work each one was soon at the office.

Those present on the happy occasion on Valentine Day were: Mr. and Mrs. P. H. Lyday, E. E. Wagner, Marcena Corcoran, Carrie Lutz, Sophia Kienele, Elsie Baldwin, Goldie Cooperider, Pearl McDonald, Mrs. Fannie Andrews, Martha Stevens, D. C. Phillips and the honor guests, Miss Dessa Weaver and Lem Nowlen.

At a recent meeting of the Kansas City Oil Men's Association, which has a membership of some 300, Mrs. C. Tobie of the Kansas City Telephone Co. told the oil men something about the telephone.

That her talk was well received is indicated by her election to honorary membership in the association. Mrs. Tobie's talk was made in connection with a program the Kansas City company has under way of showing the public through its new Telephone Building.

There are many things in Mrs. Tobie's talk that can be utilized by other companies, so it is reproduced here:

First thing, it is something entirely new to me, to stand up here and talk to you face to face. In the telephone office, operators have occasion to talk to most of the business men in our city some time during the day; in many cases, many times during the day. But we have the great misfortune of not being able to look them in the face, while we are carrying on our business dealings with them and see what a splendid lot of men we are dealing with.

The telephone office is truly a business office—the busiest business office in any town. It is a strange thing how little you men know about the telephone company, yet it is more closely linked with your business organization than any other institution in your city.

I don't know how many people are waited upon in the mercantile establishments of Kansas City every day. I imagine some analytical advertising man has worked out that data, but I doubt if, in his analysis, he has compared that number with the number of subscribers waited on by the telephone company every day. If such a comparison were made I know, without a shadow of a doubt, that it would be found that the telephone company waits on as many people every hour as all the business establishments of Kansas City combined wait on in one day.

The strange part of it is that those same people who will stand in line to await their turn at a ticket office or at the counter of a store all expect to be waited on at once in the telephone office. They do not realize that at the telephone office there are only a given number of operators to handle the subscribers, just the same as in any store there are only a given number of clerks.

It is true that to an extent the telephone company is equipped in such a way that it can handle a great deal more business than a mercantile establishment, but that equipment is only valuable as long as the subscribers, as well as the operator in the central office, are willing to use it in the right way.

Men who treat the machinery in their motor cars and flivvers like a mother's first child, sometimes treat a telephone like a piece of junk. Perhaps they would not do it if they realized that the instrument is more delicate than a jewelled watch and nearly as expensive.

You would be surprised at the crazy questions we are asked every day.

The other day one woman asked "What are the parcel post rates in zone three?" One wanted to know how to spell as-a-fet-ida. Another wanted to know to whom to make checks payable at a laundry. But best of all was a woman who called and asked for the name of the driver of a bakery wagon drawn by a grey horse named "Chub." The driver had been whipping the horse and she wanted to report him to the Humane Society.

Mr. James has requested me to talk to you about the evolution of the telephone. With the help of my memoranda I will give you a few brief items. June 2, 1875, the telephone was born. Alexander Graham Bell was in his old workshop in Boston, Mass., which was similar to a blacksmith shop of today. His electrical mechanic, Thomas A. Watson, was in a sleeping room above and their telephone wire was carried down the banisters of the stairway. The first transmission of the human voice was over this short wire just 47 years ago.

October, 1876, was the first time the telephone was taken out of doors. The Walworth Mfg. Co. gave Dr. Bell permission to use its private telegraph wire from Boston to Cambridge, a distance of nearly two miles. Thomas Watson selected one of their best instruments, went to Cambridge, waited until Dr. Bell signaled him from Boston on the Morse sounder; then he cut out the sounder, cut in the telephone and listened. Plainly as one could wish, came Bell's "Ahoy, Ahoy."

April, 1877, the first out-of-door telephone line was run between Charles Williams' office, 109 Court street, Boston, and his home, in Somerville. The event was a headliner in the morning papers.

About this time Dr. Bell gave three lectures to a well-known scientific society at the Essex Institute, Salem, Mass., to members only. Each time the hall was packed to capacity, so that a written request was made that lectures be given at the city hall at Lawrence and that an admission be charged.

Among those signing this request were Oliver Wendell Holmes and Henry Wadsworth Longfellow. Cards were printed; try to picture how they looked. Telephone! Telephone! The Miracle—The Wonder of the Age. City Hall, Lawrence, Mass., May 28, 1877.

At this time there were only 27 miles of wire in the United States, and this had to be operated in conjunction with the telegraph, and only after laborious efforts

WHO WORKS FOR ALL.

Many people think of success as they think of a four-leaf clover. If they are the chosen favorites of fortune, they think they will find it. But success is not luck. Success is playing the game; playing on the team. Organized effort will produce a more far reaching brand of success than individual work.

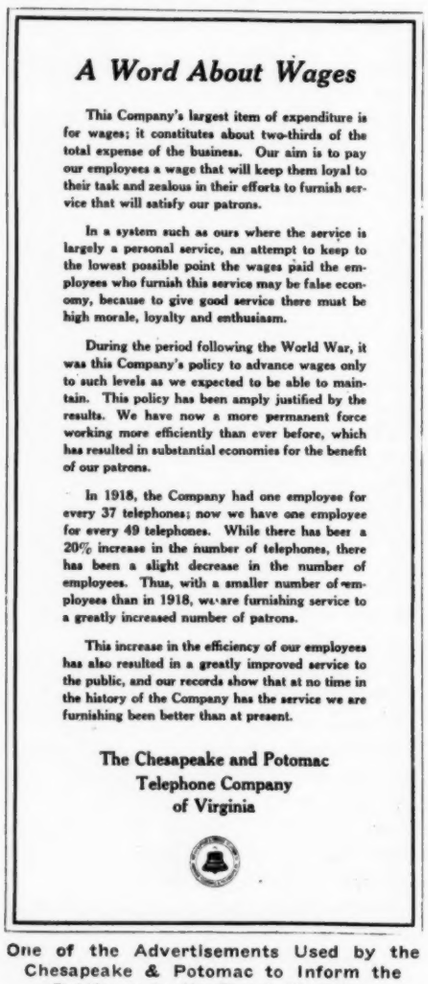
It is a curious contradiction of nature that the greatest help towards the success of one's self is unselfishness, and he who works best for all certainly works best for himself.—L. M. Boomer.

and many, many trials could they get transmission.

Forty-five years ago celebrated men were signing a request to be allowed to pay an admission fee just to hear that the human voice could be carried by means of a wire! Today we invite you to our new telephone building, 11th and Oak streets, where we have the largest automatic unit in the world; where you may see the completion and perfection of a life-time study of the greatest electrical engineers and scientists the world has ever known. Today from every foreign country in the universe, engineers are coming to see and study this wonderful equipment, almost everyone remarking, "I never thought such a thing could be possible."

In Kansas City we answer one million telephone calls a day; 97 per cent are in ten seconds, 98 per cent are established correctly.

Realizing that our local and long distance lines have to and do play a very great part in the development, transportation and distribution of the oil industry, it might interest you to know that Kansas City completes a higher percentage of her long distance calls than New York City, and she does a bigger toll business than St. Louis and many other larger cities of the United States.



A Word About Wages

This Company's largest item of expenditure is for wages; it constitutes about two-thirds of the total expense of the business. Our aim is to pay our employees a wage that will keep them loyal to their task and zealous in their efforts to furnish service that will satisfy our patrons.

In a system such as ours where the service is largely a personal service, an attempt to keep to the lowest possible point the wages paid the employees who furnish this service may be false economy, because to give good service there must be high morale, loyalty and enthusiasm.

During the period following the World War, it was this Company's policy to advance wages only to such levels as we expected to be able to maintain. This policy has been amply justified by the results. We have now a more permanent force working more efficiently than ever before, which has resulted in substantial economies for the benefit of our patrons.

In 1918, the Company had one employee for every 37 telephones; now we have one employee for every 49 telephones. While there has been a 20% increase in the number of telephones, there has been a slight decrease in the number of employees. Thus, with a smaller number of employees than in 1918, we are furnishing service to a greatly increased number of patrons.

This increase in the efficiency of our employees has also resulted in a greatly improved service to the public, and our records show that at no time in the history of the Company has the service we are furnishing been better than at present.

The Chesapeake and Potomac
Telephone Company
of Virginia

One of the Advertisements Used by the Chesapeake & Potomac to Inform the Public as to Its Exact Situation.

I have given you this information not in a boastful spirit but because I have confidence in your civic pride. I know that I am very proud of the fact that the percentage of the oil distribution of Kansas City is the greatest in the United States. You may like to know, too, that we use from six to ten thousand gallons of your oil per week to heat our building.

According to statistics issued December 31, 1921, there were about 14 million telephones and about 32 million miles of wire in the United States. This is enough wire to circle around the world 12 thousand times and would make a two-wire line to the moon 53 times.

The telephone investment in the United States represents approximately two dollars a minute since the birth of Christ—2,020 million.

The maximum sized cable in Kansas City carries 24 hundred wires. This cable is only three inches in diameter. Each wire is insulated with wrappings of porous paper. A special paper has to be used, and so far nothing has been found that will answer the purpose except paper made from old manila rope.

To give you some conception of the number of wires that enter our building, if we used aerial lines instead of underground conduits, it would take a pole 35 hundred feet high or the equivalent in length to seven or eight city blocks, with an arm every foot, to carry this wire into the building at 11th and Oak.

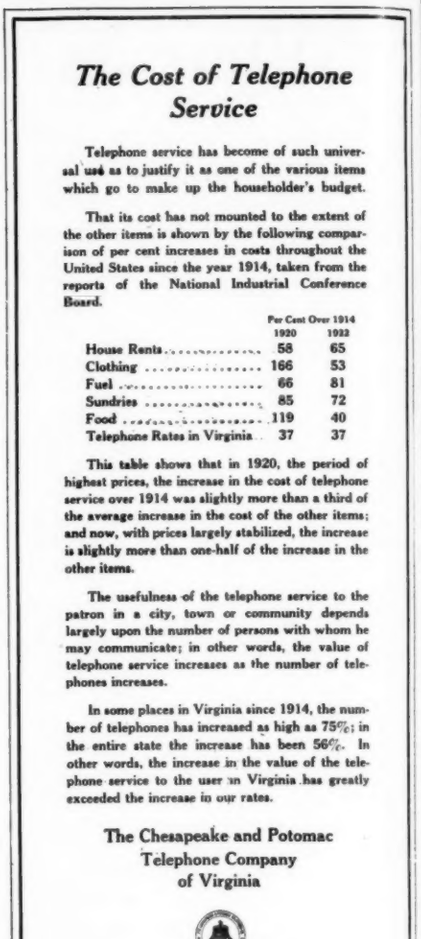
I came over today to invite you over to visit our new building. Don't feel that you will have to depend on me to show you through the building, but we will have sufficient electrical engineers waiting to show you as completely and expediently as possible. A good motto is, "Do it now," so "let's go!"

I thank you.

The past few months the Chesapeake & Potomac Telephone Co. has been using newspaper advertising to fully and carefully inform the public as to its exact situation. In December a series of four advertisements were run in the newspapers in the company's territory.

The first one was entitled, "The Public's Interest in Telephone Earnings." In it was stated that the company had no desire to charge extortionate rates; that the public was entitled to just as low rates as possible, consistent with good service, and that that had always been the policy of the company.

When the company asked for increased rates in 1920, it did not ask for rates sufficient to earn an adequate return to its stockholders, because it felt that the public should not be asked to make up the entire amount of the increased cost; it stated that it was willing to do its part and by means of greater efficiency and economy, to co-operate with the public in bringing



The Cost of Telephone Service

Telephone service has become of such universal use as to justify it as one of the various items which go to make up the householder's budget.

That its cost has not mounted to the extent of the other items is shown by the following comparison of per cent increases in costs throughout the United States since the year 1914, taken from the reports of the National Industrial Conference Board.

	Per Cent Over 1914	
	1920	1922
House Rents	58	65
Clothing	166	53
Fuel	66	81
Sundries	85	72
Food	119	40
Telephone Rates in Virginia	37	37

This table shows that in 1920, the period of highest prices, the increase in the cost of telephone service over 1914 was slightly more than a third of the average increase in the cost of the other items; and now, with prices largely stabilized, the increase is slightly more than one-half of the increase in the other items.

The usefulness of the telephone service to the patron in a city, town or community depends largely upon the number of persons with whom he may communicate; in other words, the value of telephone service increases as the number of telephones increases.

In some places in Virginia since 1914, the number of telephones has increased as high as 75%; in the entire state the increase has been 56%. In other words, the increase in the value of the telephone service to the user in Virginia has greatly exceeded the increase in our rates.

The Chesapeake and Potomac
Telephone Company
of Virginia

This Ad. Presented Some Facts Which Are Not Usually Taken Into Consideration by the Telephone Using Public.

about the desired aims; namely, good service—the best that can be given and at a fair price.

Then it was stated what the company had been doing to effect greater efficiency and economies, and the advertisement concluded with the statement that for the first nine months of 1922 the company was earning only 5.7 per cent on the value of its property, so that the public would not think that it was attempting to earn upon anything else, thus answering the idea or suspicion that it was attempting to earn on other than the actual property.

In the second advertisement, which is reproduced on this page, a question was discussed which is vital from the standpoint of the employe and is also of considerable concern to the public. It was entitled "A Word About Wages."

In the third advertisement, also reproduced on this page, "The Cost of Telephone Service," was discussed. Facts were presented that it was felt were unfamiliar to the public.

Service charges were discussed in the fourth advertisement and the company explained that they were applied because it was felt they were equitable to the public.

Transmission Over Long Cables

repeaters and associated appartus designed to equalize the transmission, while the dotted line shows what the characteristic would have been had the repeaters introduced exactly the same amount of gain at all frequencies.

Transients.

In comparatively short telephone circuits, good quality will usually be assured if the transmission, as measured at different single frequencies within the voice range, is kept approximately constant. For electrically long circuits, however, this is not sufficient. Not only must the "echo" effects be kept within proper limits, but consideration must be given to the fact that when electrical impulses are applied to such circuits, peculiar transient phenomena are experienced.

These transient phenomena occur in equal degree in two-way circuits and in circuits arranged to transmit in one direction only; that is, they are not related to "echo" effects.

A large number of oscillograms have been taken in connection with the study of these transient effects. From these and theoretical considerations* it has been proved that the effects in a given circuit are much worse at high frequencies than at low frequencies, the severity of the effects, within certain limits, being a function of the ratio of the frequency being transmitted to the frequency of cut-off of the loaded circuit. The gage of the circuit has practically no effect.

Since in order to give good quality it is necessary to transmit fairly well all frequencies up to at least 2,000 cycles, it is obvious that on long circuits in order to keep the transient effects small, the frequency of cut-off must be kept high. In order to do this, it is necessary either to make the loading coils of very low inductance or to space them very close together.

This is another one of the reasons why extra light loading was adopted for the long cable circuits. (It will be remembered that the inductance of the side circuit loading coils is only 0.044 henry and the spacing 6,000 feet.)

(Continued from page 16.)

As has been pointed out, the magnitude of the line transmission loss in a repeatered circuit is of comparatively small importance in determining its possible transmission equivalent, whether the circuit be worked on a four-wire or two-wire basis. However, it is of extreme importance to be sure that the repeater gains are kept adjusted so as to compensate exactly for a large part of the transmission loss in the circuit, so that the difference between the total loss in the circuit and the total gain, which represents the net equivalent of the circuit, will be kept constant.

On certain of the long circuits this difference is very small as compared to the quantities which are subtracted. For example, in the case of a 1,000-mile four-wire circuit using x.l.l. No. 19 gage conductors, the total line transmission loss is about 500 miles. Not counting the gain required to make up for losses in apparatus and office cabling, the total gain is about 488 miles, the difference, 12 miles, representing the net equivalent.

Evidently only a very small percentage change in either the transmission losses or the gains will have a large effect on the net equivalent. This represents about the most severe condition. Some examples of less severe conditions are:

Two-wire No. 19 m. h. l. circuit 200 miles long (320 kilometers). Line equivalent 58 miles. Repeater gain exclusive of gain required to make up for loss in apparatus and office cabling 46 miles. Net equivalent 12 miles.

Four-wire No. 19 m. h. l. circuit 500 miles long (800 kilometers). Line equivalent 145 miles. Repeater gain exclusive of gain required to make up for loss in apparatus and office cabling 133 miles. Net equivalent 12 miles.

In order to maintain the necessary constancy of the overall or net transmission equivalent of long repeatered circuits in cable, it is necessary first of all to maintain the gains of the individual repeaters within close limits. In addition, periodic transmission measurements are required over the complete circuits, supplemented by suitable adjustment of certain of the individual repeaters whenever the overall equivalent falls outside of the prescribed limits.

Variable Quantity	Prescribed Limits	Gain Variation
Plate Potential.....	130 ± 5 volts	± 0.2 mile
Grid Potential.....	9 ± 1 volt	± 0.3 mile
Filament Current.....	1.25 ± 0.05 ampere	very small for new tube—one mile for tube just before replacement.

Operating Limits of Currents and Potentials, With Gain Variations, for One Type of Tube

Also, on the very long small gage circuits, the changes in attenuation, due to the resistance changes caused by temperature variations, become so large that it is practically essential to provide automatic means for overcoming these effects.

The methods employed in maintaining the gains of the individual repeaters and of the overall transmission equivalents within proper limits will first be described, after which the automatic transmission regulators will be discussed.

Important Tests and Adjustments.

In order to hold the repeater gains constant, close inspection limits are placed on the vacuum tubes during the course of manufacture to insure great uniformity of the product, as well as consistency of performance. In operating the repeaters, considerable care is taken to maintain constancy of operating currents and voltages.

The operating limits of currents and potentials together with the corresponding gain variations for one of the types of tube in common use are given in the accompanying table.

In addition to maintaining the tube currents and voltages within the required limits, the gains of the individual repeaters are checked periodically. Suitable adjustments are made when the repeater gains fall outside of the prescribed limits. When the filament emission of a tube becomes so low that the above specified variation in the filament current results in more than one mile gain variation, the tube is replaced.

A gain measuring device as indicated

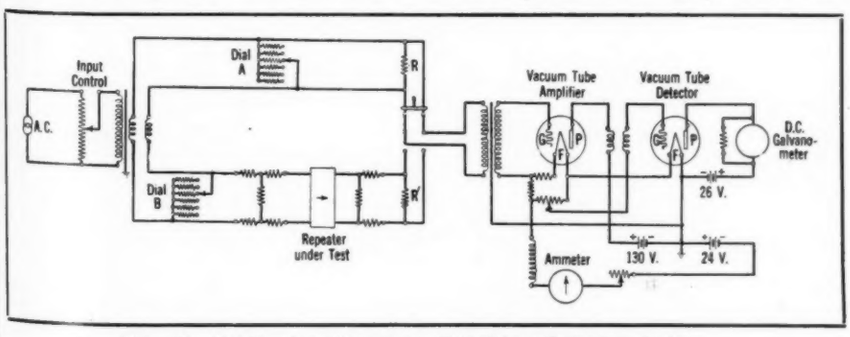


Fig. 10. Device for Measuring Telephone Repeater Gains.

*John R. Carson—"Theory of the Transient Oscillations of Electrical Networks and Transmission Systems." Transactions of A. I. E. E. Vol. XXXVIII, page 407.

schematically in Fig. 10 is employed for this purpose. The measurement of gain is effected by comparison of the voltages across two resistances, one of which forms part of a circuit which includes the repeater, the other being simply a reference circuit.

An amplifier-detector combination amplifies the voltages across these resistances and then rectifies them so as to obtain an indication on a d-c galvanometer. Equality of voltages across the two resistances, which are designated as R and R' in the figure, is thus indicated by equal deflections of the galvanometer. When this condition is secured, the repeater gain is read directly from the dials A and B.

By means of this device, it is readily possible to measure the gain of a repeater within a few tenths of a mile. Owing to the fact that the measuring circuits are comprised entirely of resistances, the readings of the set are independent of frequency, so that gains can be measured at all important telephone frequencies.

As pointed out, transmission measurements over the complete circuits including the telephone repeaters are required at periodic intervals in order to insure that proper transmission standards are being maintained.

By means of such measurements, the variations in the over-all equivalent of the circuits due to the cumulative effect of small gain variations, slight variations which remain after the automatic transmission regulators have compensated for the major variations in the conductors and variations from other causes including the effect of different conditions of humidity on the wiring in the offices, are determined and compensated for.

These measurements are made by applying a known electromotive force through a known resistance to one end of the circuit and receiving the current at the distant end with a suitable calibrated arrangement employing an indicating meter. Since this type of measurement is similar in principle to the method employed for measuring the gains of the individual repeaters, it will not be described.

Automatic Transmission Regulators.

Since the resistance of long cable circuits employing small gage conductors is comparatively large, it is, of course, evident that changes in this resistance caused by temperature changes to which the cable circuits are subject will have a large effect on transmission.

For example, in the case of an x. l. l. No. 19, 1,000 mile circuit (1,600 kilometers) in aerial cable, the total attenuation changes more than 110 transmission miles during the course of a year. This corresponds to a variation in the received power of more than 10^{10} or ten billion times.

It is, of course, essential to provide special means to counteract these effects. Furthermore, since the temperature changes which occur in an aerial cable are very rapid, it is practically essential to make these means automatic. In the case of x. l. l. No. 19 circuits whose variation is greatest, it is necessary to locate the automatic regulators, in general, at every third or fourth repeater station in order to keep the transmission levels within proper limits.

In Fig. 1-*a*, a typical method of locating the regulating devices along a cable is indicated. In this sketch each square indicates a master automatic transmission controlling device while the loops extending in either direction from the squares indicate the cable circuits which control the functioning of these devices.

An automatic transmission regulator is shown schematically in Fig. 11. The device comprises a Wheatstone bridge arrangement. In one arm of the bridge, pilot wire pairs, extending in either direction in the cable, are included as indicated in the figure. The Wheatstone bridge has associated with it certain apparatus which will not be described here in detail, which functions in such a manner as to keep the bridge automatically balanced at all times.

In the process of maintaining balance of the bridge, angular motion is conveyed to a shaft which is proportional to the resistance variations which the cable circuits undergo. The movement of the shaft causes different contacts to be made and thus controls relays which in turn control the gains of the telephone repeaters, one way of doing this being indicated in the figure. The repeater gains are thus caused to be raised and lowered automatically, and thereby overcome the differences in attenuation caused by the temperature changes in the cable conductors.

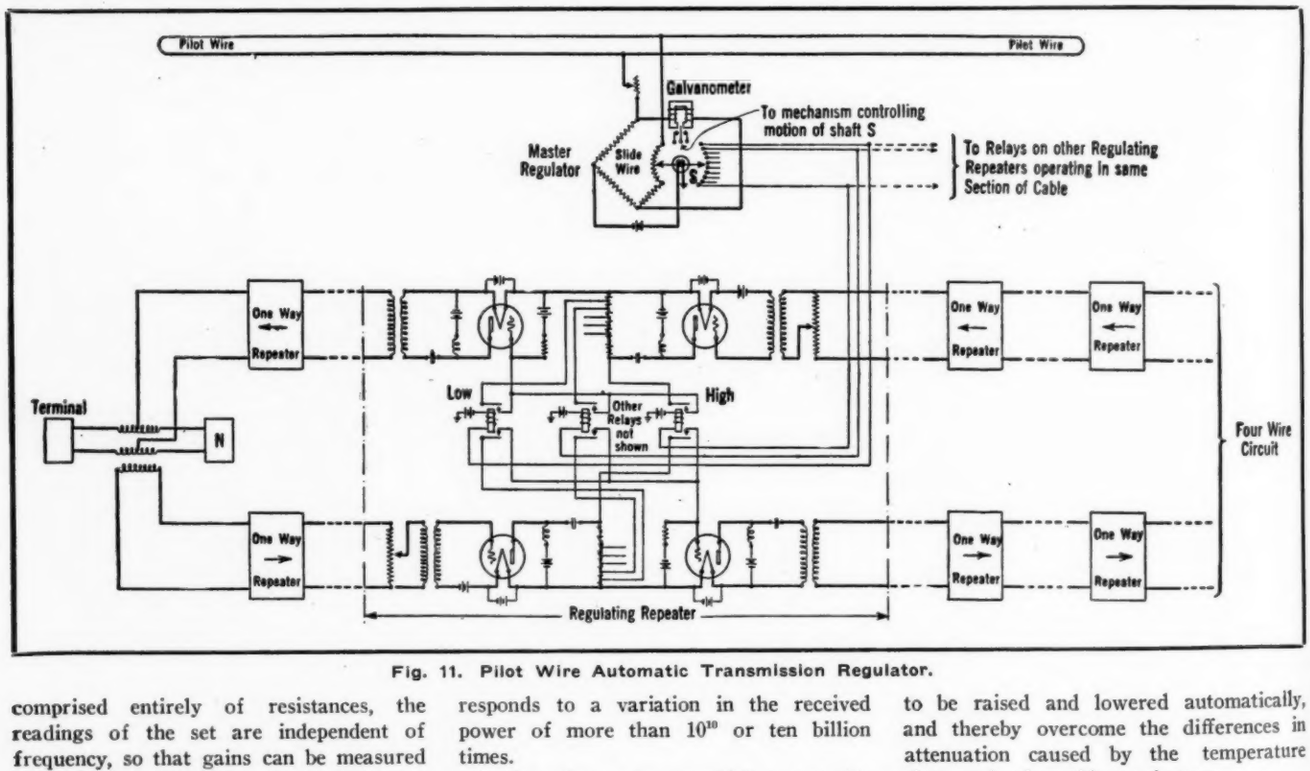


Fig. 11. Pilot Wire Automatic Transmission Regulator.

Minnesota Rural Company Reports That 1922 Was a Good Year.

The Hanska Rural Telephone Co., of Hanska, Minn., has made good progress in a financial way during the past year, according to the secretary's report. The directors recently declared a 10 per cent dividend.

The total resources of the company aggregate $18,416, including $13,755 worth of lines and equipment, and real estate and office equipment valued at $1,956.

There is $11,525 worth of capital stock outstanding, and $3,485 represents the depreciation reserve.

Telephone rentals collected during the past year amounted to $7,150, while the tolls collected aggregated $1,284.

Operating Costs at Indiana Hearing

Service of Independent and Bell Exchanges Compared and Efficiency of Equipment Discussed by J. K. Johnston — Traffic Savings, Operating Efficiencies and Appraisals Gone Into at Length in Indiana Bell Hearing

Service of the Independent telephone companies in the state ranks just as good as, if not better than, the Indiana Bell company's service, according to J. K. Johnston, telephone engineer of Indianapolis, who testified last week as an expert witness for the Indiana Public Service Commission at the consolidated rate case hearing at Indianapolis.

Inasmuch as the rates of the Independents are generally less than rates of the Bell, it appeared that the commission was trying to show by Mr. Johnston's testimony that there is not a difference in service sufficient to account reasonably for the difference in rate. E. L. Cline, president of the Madison Telephone Co., testifying as an expert, told how traffic savings of $115,209 a year could be effected in the Indianapolis exchange of the Bell company, and Earl Carter, chief engineer for the commission, submitted an appraisal of the total physical property of the Indiana Bell, which was about $10,000,000 less than the appraisal of B. G. Halstead, engineer for the company. These were some of the high lights of the hearing during the week.

Mr. Johnston testified that he had found practically all of the Independent properties he had appraised in good condition with good equipment, all of them using harmonic or secret ringing for party lines, while he said the Bell semi-selective ringers are not secret. The number of subscribers of the Independents was nearly up to capacity, he said, and as a rule there were not many spare facilities.

In answer to questions by Commissioner Glenn Van Auken, he said he had appraised Independent telephone properties at Elkhart, Goshen, Greensburg, Wabash, Winchester, LaPorte, Greencastle, Noblesville, Liberty, Winona (including Plymouth and Knox), Franklin, Portland and Decatur and is now appraising the property at Richmond. The commissioner asked him about the per cent conditions he had found and about the kind of switchboards used.

Mr. Johnston and F. S. Chapman for the commission, visited LaCrosse, Wis., to study the Kellogg feature switchboard there and to make estimates on what it would cost to put in such features for the Bell plant at Muncie and what the traffic savings would be. They also visited Muncie.

Mr. Johnston testified that the feature switchboard if put in at Muncie, would reduce traffic costs of operators about 50 per cent. He testified that it would enable the Bell company at Muncie to reduce the number of operators from 52 to 25.

He estimated the net cost of capital additions for putting in the feature equipment at Muncie at $89,337. A Bell company expert had estimated it at $74,700, a lower figure, but Mr. Johnston testified that the company's expert study did not show just how much equipment was proposed, so the figures could not fairly be compared. He estimated the net decrease in traffic costs at Muncie, with the proposed changes put in, at $7,933 a year.

W. H. Thompson, attorney for the Indiana Bell, in cross-examining Mr. Johnston, referred to an article written by Mr. Johnston a few years ago on depreciation based on a study of about 20 exchanges. He asked him whether it was true that he said the proper rate of depreciation on present or depreciated condition was 8½ per cent.

Mr. Johnston said it was true but that without an explanation his position would not be understood. He said he had allowed for a low maintenance charge. If the maintenance charge is high, the depreciation rate should be correspondingly lower, he said.

In the earlier history of the telephone business there was more inadequacy than there is now and more obsolescence, he said. The territory has been more fully developed and inadequacy and obsolescence had been reduced, he said.

Mr. Johnston said he had found rural lines mixed on the Muncie switchboard with city lines. This was uneconomical, he believes, and he thought the company should put the rural lines on a separate board. He said rural calls were slower, talks longer, and the system of ringing for rural calls different.

Mr. Johnson was cross-examined by Mr. Thompson Friday afternoon. At that time he asserted that the Bell interests, after acquiring telephone plants of the Independents, had maliciously destroyed property; that many of the inventions and improvements in the telephone business had been originated by Independents rather than by the general staff of the A. T. & T., and that the Bell interests were not fair enough and manly enough to give credit where credit was due; that because of prejudice against Independent equipment, and a policy of putting in their own, rather than because of a desire to improve service, Independent equipment had been thrown out, and that taking the state as a whole, the quality of service, if there is any difference between the Bell and the Independents, is better as given by the Independents.

His assertion that the Bell interests had maliciously destroyed property was stricken from the record, but he did not take back any of his statements.

As a witness for the commission, he said he had tested the service of the Bell company at Muncie, Anderson and Bloomington, and had found the service at Bloomington fully as good, if not better, than at Muncie and Anderson. At Bloomington many of the old Independent instruments are still in use. He said the Sterling switchboard at Bloomington is about 18 years old and about 1,000 of the original telephone sets are still in use and giving good service. This, he said, convinced him that the Bell policy followed in many places of throwing out Independent instruments was not right.

It was brought out by Frank B. Faris, of counsel for the commission, that there are six types of station instruments in use at Bloomington. Mr. Johnson replied that there was no impairment of service because of a difference in the make of the instruments.

In testifying in regard to traffic savings, Mr. Cline pointed out that a total saving of $9,456 a year could be effected for 20 exchanges in the central district outside Indianapolis. He computed the savings on the assumption that the same central office equipment would be used as is now in use, and his calculations had nothing to do with proposed more economical central office equipment, or with savings in other traffic expenses than cost of operators.

He testified that in some of the exchanges he would use more operators, or operator hours, than the Indiana Bell. For exchanges studied outside Indianapolis, he did not regard the savings that could be effected as very considerable.

For 20 exchanges in the central district outside Indianapolis, he calculated a total

A CREED.

To do the right thing, at the right time, in the right way; to do some things better than they were ever done before; to eliminate errors; to know both sides of the question; to be courteous; to be an example; to work for the love of the working; to anticipate requirements; to develop resources; to recognize no impediments; to master circumstances; to act from reason rather than from rule; to be satisfied with nothing short of perfection. — The Marshall Field Creed.

saving of 662 hours a week, or 34,437 hours a year, which at the average rate of wages, would amount to $9,456 a year. The marked saving, which he testified could be made, would be in Indianapolis. The saving, by more efficient direction of operators, he said, would be 6,349 hours a week in Indianapolis, or 330,167 hours a year, or $115,209 a year. As to the main exchange in Indianapolis, he said his set-up would not show a saving, but the contrary, but there would be a marked saving in the other Indianapolis exchanges.

He testified that he found at Shelbyville the rural lines were operated from the toll section of the switchboard. Answering a question of W. R. Myers, city attorney of Shelbyville, he said the effect of this was to slow down rural traffic about one-half. He also said a change could be made to correct this condition for about $600.

Mr. Carter made two appraisals, which were submitted to the commission. His appraisal on the basis of unit prices for the five-year period 1913-1917, together with the actual book cost of net additions to capital for certain periods after 1918, is $27,374,518 reproduction new, and $24,-635,600 present condition.

The $24,635,000 present-condition value, as found by Mr. Carter, is comparable with the $35,139,764 present-condition value as of October 31, 1922, found by Mr. Halstead, the company's appraisal engineer. It is $10,504,164 less than the company's figure submitted to the commission a few weeks ago.

In this appraisal Mr. Carter allowed 12 per cent for structural overhead, which amounted to $2,038,057. In the company's figure of $35,139,764 as present condition value, the percentage claimed for structural overhead was nearly 20.

In his second appraisal Mr. Carter used average unit cost prices for a ten-year period, 1913-1922, with adjustments made by striking down abnormal peak prices of 1917 and 1920. Instead of using the peak prices of 1917, he used for 1917 the average prices for 1916 and 1918, and instead of using the peak for 1920, he used the average for 1919 and 1921 for 1920. On this basis his appraisal of the value of physical property is $29,120,630. This appraisal is comparable with the company's figure of $35,139,764 as present condition value. The commission engineer's appraisal in this case is $9,018,914 less than the company's.

In the second appraisal Mr. Carter allowed 15 per cent for structural overhead.

The company engineer used average unit prices for the five-year period 1916-1920, plus actual cost of additions to capital for periods differing for the different exchanges. The period for unit prices used by the company was one of high prices. The periods used by the commission engineer included some years before the war had sent prices up.

In Mr. Carter's appraisals the actual cost of net additions used was about $5,-000,000, so it appears that of the total amounts of his appraisals about one-fifth was actual costs of additions to plants in recent years, and these were high-price years.

The present condition value of the Indianapolis exchange area under Mr. Carter's first appraisal is $11,086,320 as against $15,160,873 claimed by the company, or $4,074,553 less than the company claims. Under Mr. Carter's second appraisal the present condition value of the Indianapolis exchange area is $11,731,088, or $3,429,785 less.

In the figures of Mr. Carter no deductions have been made for duplicated property either in the case of Indianapolis or other exchanges. At the direction of the commission Mr. Carter is now making a study of duplicated property and other property that may not be considered "used and useful" within the meaning of the law. His finding will be submitted to the commission later and it is believed that might operate to reduce the value considerably.

The company claims a total value for rate-making purposes of $42,611,590. This includes the $35,139,764 for physical value, present condition, $7,027,952 for going value, which is 20 per cent of the former figure, and $443,873 for working capital.

Mr. Carter's figures do not include anything for going value. They do include about $607,000 for materials and supplies, but nothing for working cash capital, which presumably is represented by the company's figure of $443,873 for working capital.

The company asks 20 per cent for going value. In the hearing, the commission has indicated an opinion that 20 per cent is much too high. Should 10 per cent be allowed in the Carter appraisals, it would appear that the commission would find a rate base of from $28,000,000 to $30,000,-000, or not far from the book value of the company which is estimated at about $30,000,000.

In that case the rate base found by the commission would be about $12,000,000 less than that claimed by the company, or about 30 per cent less.

In a setup of revenues and expenses and estimated increased revenues under the proposed higher rates, the company calculated that it would earn 4.8 per cent on the basis of $42,611,590. The company is asking for an annual depreciation allowance as an operating expense of $1,781,133, or 6.08 per cent of the book cost of depreciable property, $29,272,352.

Testimony of the commission's witnesses has been to the effect that 4 per cent is enough for depreciation, as shown by experience from the books. If 4 per cent were allowed the operating expenses would be reduced about $600,000 below the amount claimed by the company.

How One Illinois Operator Regards Eight-Hour Day Bill.

Illinois telephone operators are taking an interest in the proposed eight-hour day bill now before the state legislature, as shown by the resolution of protest published in last week's issue. One of the operators of an Illinois exchange, under date of March 1, wrote to the members of the legislature in the district in which she resides as follows:

As a telephone operator, I emphatically protest the "Eight Hour Law on Telephone Service and Telephone Female Employes," as being detrimental to the public and company also. The situations with the telephone company are not comparable to those with which factories and mercantile businesses must cope. Our work is quite different and laws which might benefit factory employes are not applicable to telephone operators. The latter are not classed with the former and the same law cannot govern both.

The working hours of a telephone operator are so arranged as to give two minimum relief periods of 15 minutes each during a period of eight hours. With a two-hour luncheon period, any ordinary operator under ordinary conditions is fit in every way and quite willing, if necessary, to operate a period of overtime not to exceed two hours, making the maximum period ten hours.

In cases of emergency, the telephone is foremost in the mind of the public because of the rapid means of communication. Rapid and efficient service is required. In effecting the "Eight Hour Law" this valuable service would be greatly impaired. For instance, an unavoidable delay might detain the night operator, who relieves the day operator. An important call is being completed, transmitting the acceptance of an important contract. At the end of eight hours the day operator must release her circuit, suspend all work on the call and leave the exchange building immediately. The call is later completed by the night operator, when she arrives; but the contract has been closed with another. Lack of prompt and efficient service has lost the contract and, perhaps, thousands of dollars for the subscriber.

Constant demand and imperative need of telephone service by the public creates a situation not attainable by any other business. We operators do not declare a holiday and journey to the woods for a day's outing. That is utterly impossible. Our doors are always open and our lines are always ready to serve at any minute, day or night.

During special events, such as annual celebrations, conventions, meets, etc., our lines are pressed with heavy traffic, which requires more operating. It is impossible to retain extra operators, since the work is so small. One who does not work daily is not efficient. Enforcing the eight-hour law would impair the service to a great extent. During the year 1922, I was absent from the telephone office three weeks. My total overtime amounted to less than eight hours, and I worked each and every time I was asked and as much overtime as any other operator.

The working conditions of a telephone operator are not to be compared with a factory employe. The factory is a smudgy, dusty, noisy place with very little room. Our telephone office is a large, roomy building with windows all around and equipped with electric fans, which render

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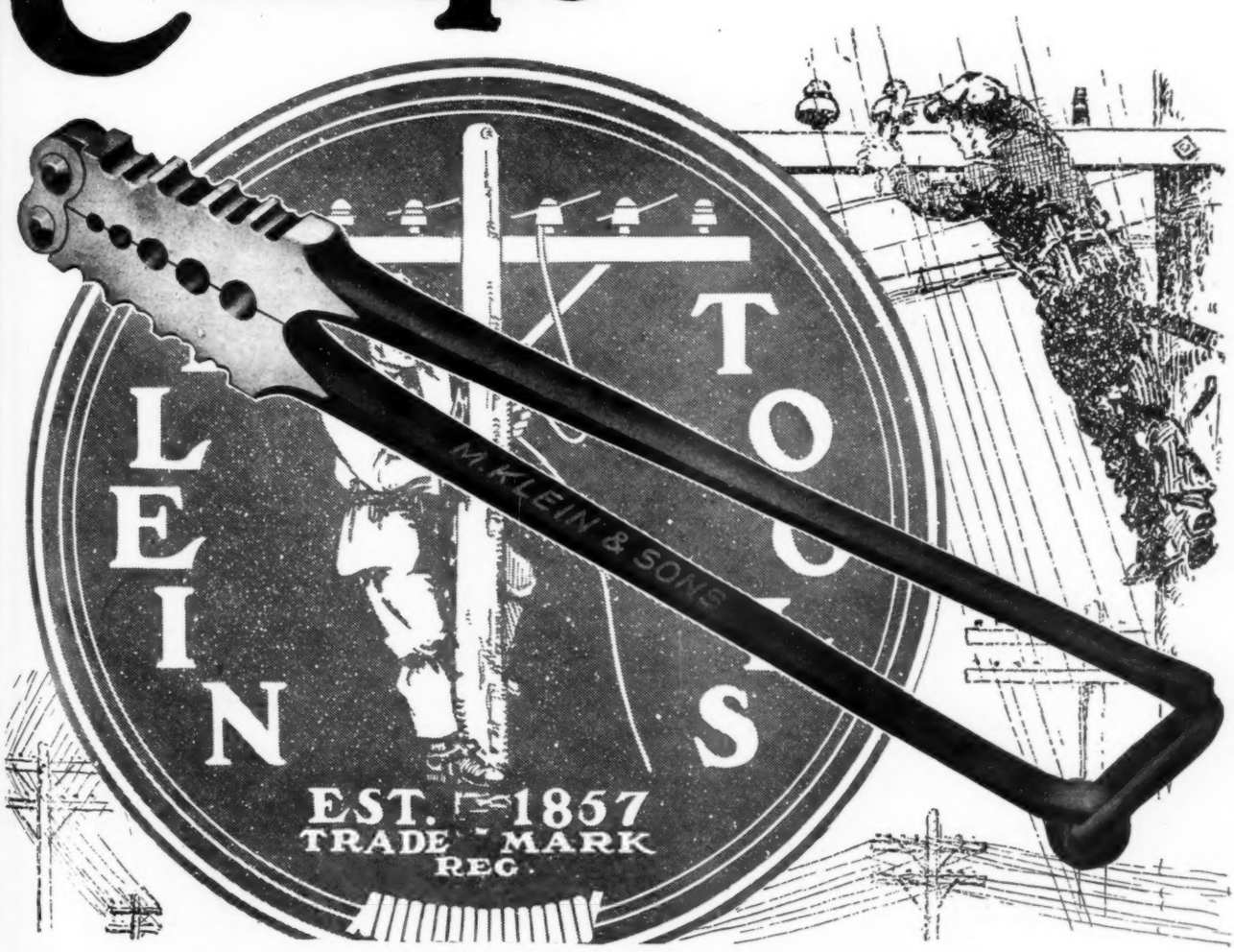
They appreciate the specially designed joints that permit a Klein Splicing Clamp to work freely without loss of alignment. They like the hang, shape and spring of the handles. They know the dies are snugly fit to gauge, will not injure the wire or sleeves when twisted.

Buy your outside gangs the best—Klein Splicing Clamps!



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the room cooler than the average place of business. Why is a telephone operator not fit in every way to operate for a period of overtime not to exceed two hours?

Traffic, as a whole, is not always steady and our schedules are arranged to best co-operate with all situations. It has and always will be the best policy for a telephone company to employ a regular number of operators and arrange the schedules with little or no overtime, to meet the demand of the public satisfactorily. Our situations are not governed by us; they are the result of conditions uncontrollable by us and the continuous demand of the public.

I, as an operator, for three years in the traffic department of one of the large telephone companies of Illinois, protest the proposed "Eight Hour Law on Telephone Service and Telephone Female Employes" as being detrimental to the public and all concerned.

Platte County Independent Sold to Lincoln, Neb., Men.

Control of the Platte County Independent Telephone Co., with headquarters at Columbus, Neb., has been sold to a group of telephone men who manage the destinies of the Lincoln Telephone & Telegraph Co. Frank H. Woods, R. E. Mattison, W. E. Bell and W. L. Lemon have purchased two-thirds of the stock from the controlling interest, owned by C. J. Garlow, president; R. Y. Lisco, vice-president; G. W. Phillips secretary-treasurer, and Charles Louis and Fred Kluck.

The transfer was effected at a conference of the five directors with Mr. Bell and Mr. Lemon. In its deal, the Columbus men all resigned, and a new official list was named, with R. E. Mattison as president; W. E. Bell, vice-president; W. L. Lemon, secretary and treasurer, and Mr. Woods on the board, along with Mr. Phillips.

The Platte County company operates in that section of the state north of the Platte river in which the Bell company has been supreme since 1912, when the Lincoln company sold to it all of its exchanges north of the river and bought all of the Bell properties south of the river, as far west as Kearney county. Platte county, however, adjoins Polk and Butler, where the Lincoln company owns the principal exchanges.

Mr. Mattison said that the purchase was made as individuals and not as representatives of the telephone company, and that no plans were under consideration for joining the purchase with the operation of the Lincoln company. Mr. Garlow and his associates, he said, were anxious to sell and they made a price that was satisfactory. Clyde A. Burg, manager at Fairbury for the Lincoln company, succeeds Z. A. Kimbro, who resigned as manager of the Platte County company.

Mr. Garlow, who retires from the telephone industry, is a lawyer with a good practice, and has found the work of managing the company and keeping the legal ball in the air harder work at his age than he cares to undertake. He has been connected with the industry for a number of years, and was one of the active members of the state association for a lengthy span, serving several terms as president.

The company was organized in 1904 by Iowa men, and in 1909 Mr. Garlow and his associates purchased it. Later the Bell company put in a competing exchange, but lost money from the start. Four years ago the Bell sold its exchange property to the Platte county company, but because of the city's business importance and its being a switching center, have kept a toll-board there.

Mr. Garlow has been desirous of selling for some time, but has refused to deal with the Bell. He sought to have the new purchasers contract not to sell to the Bell, but they declined to buy with that string attached.

The company has had several run-ins with the state railway commission over rates and control of operating and accounting practices, and last year suffered a $10,000 loss by a sleet storm that put its year's operations in the red. No report for 1922 has yet been filed with the state railway commission.

The last report shows the company had about 2,000 stations. It operates exchanges at Columbus and Duncan, the latter a small town, and is a well-built and compact property. The commission's valuation of $115,000, made two years ago, was taken as the basis of the price deal. The company has outstanding stock of $56,000, a funded debt of $24,000 and reserves and other liabilities that balance the figure given for the investment. About 200 farmers and other residents of the county hold the remainder of the stock.

Commissions, Courts and Councils

Discussion and Rulings of State Bodies Having Supervision Over Telephone Companies—Decisions of Courts in Matters of Interest to Public Utilities and Actions of City Councils Relative to Franchise, Rates and Service

Bill Fixes Minimum Compensation for Toll Commission.

The Nebraska state senate has amended the bill fixing the compensation toll companies shall pay telephone companies for handling toll messages to provide that the commission shall be at least 15 per cent on originating and 10 per cent on terminating calls, thus making it possible for companies to negotiate a higher commission. This was what former President Bruce Brown of the state association, who caused the introduction of the original bill, had in mind when he asked for the repeal of the law fixing commissions.

The senate agreed to an amendment asked for by several senators from Omaha that would have had the effect of eliminating the five-cent toll charge for messages originating in Omaha and terminating at the South Omaha exchange. Later it reversed its action on this and struck it out, when it became evident that it would result in increased rates for local service in South Omaha.

One of the liveliest debates of the session was staged over the proposition. Those who favored it charged that it was a graft on the part of the Northwestern Bell, which operates both exchanges, and insisted that as South Omaha is now a part of Omaha the charge was unwarranted.

Senators who represent South Omaha said it was part of the annexation agreement that rates should not be raised. It was quite evident that if the company was deprived of revenue in one respect it would be entitled to have it made up in some other way, and that could be done only by increasing rates. It was pointed out that South Omaha has a much lower schedule of rates than greater Omaha, and that this was due to the large number of packing house employes who work only upon call and who must have telephone service in order that they may be called.

The amendment read that no tolls should be charged on messages between exchanges ten miles apart in the same metropolitan area. An effort was made to amend this by making it apply to all exchanges in the state. This was defeated after it was pointed out that many companies own only their town lines and that, if they had to give free service to every town ten miles distant, they would have to have higher rates to compensate them for the added cost.

Other senators contended that the matter was one for the railway commission to handle, and inquiry later developed that not a citizen of Omaha had ever filed a complaint against the rate with that body.

The Northwestern Bell schedule provides for a business rate of $8.80 a month in greater Omaha and $4.95 in South Omaha. It permits South Omaha to talk without expense to Omaha, largely because the messages go to the business section, but charges five cents if an Omaha

Spring Is Almost Here

Are You Planning Accordingly?

Many telephone companies are now ordering telephones to prepare for spring installations. Some are installing new switchboards and additional cable to take care of this customary spring business.

May we suggest that you anticipate your wants and place an order now for immediate or future delivery? This is the usual time of the year to plan, and to start your extension program.

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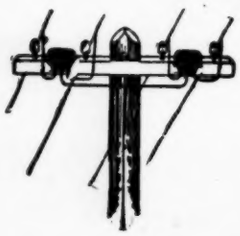

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man desires to talk with South Omaha. It defends this as better telephone practice because of the radically different business and social lives of the two communities, South Omaha being largely a packing house center.

The commission has permitted the rate for the reason that the Omaha zone rates are so constructed as to make a reasonable return, and if the message tolls were eliminated the $20,000 revenue thus lost would have to be made up for that zone by increased rates, or, if South Omaha were included in the service area by an increase in these rates.

Reduced Rates Will Not Go into Effect in Fort Smith, Ark., Yet.

On March 6 Federal Judge Frank A. Youmans overruled a motion made by the city of Fort Smith, Ark., to dismiss a petition for a restraining order against the enforcement of the ordinance providing for a reduction in local rates of the Southwestern Bell Telephone Co.

The petition was filed by the Southwestern Bell February 24, when a temporary restraining order was granted, pending consideration of the matter by the court.

The order overruling the motion means that the case will be tried on its merits in federal court in September, according to a tentative agreement between attorneys and the court.

The city commission passed the ordinance February 20, effective March 1, providing for a reduction in rates, but because of the restraining order, the proposed rates did not go into effect. It was provided in the order that the company furnish $25,000 bond to insure rebates to users in case the city should win.

The ordinance would reduce the rates on residence telephones from $3.25 to $2.90 per month, business rate from $7 to $6 per month and the rate for extension telephones from $1 to 50 cents per month.

Mutual and Rural Lines Under Authority of Kansas Commission.

Mutual or rural telephone companies in Kansas are under jurisdiction of the public utilities commission, the state supreme court held on February 10.

Hundreds of farm and mutual lines in Kansas had been made exempt from operation of the law creating the utilities commission.

In a suit brought by the commission against the Trego Coöperative Telephone Co. and the Wakeeney Telephone Co., of Wakeeney, the court held that when these mutual lines were connected with a public system, they became utilities and subject to the commission's regulations. No changes in service connections or rates can be made by them without consent of the commission.

Nebraska Maximum Rate Bill Placed on "Waiting List."

The Nebraska house judiciary committee has reported, with a recommendation for indefinite postponement, the Osterman bill which provides for maximum rates only by public utilities and permits the companies to charge any rate below that that it chooses. Mr. Osterman, however, made a successful fight on the floor of the house to rescue the bill from the legislative junkpile, and it is now on the general file for consideration after 130 others have been acted upon.

The plea made by Mr. Osterman that won future consideration for his bill was that this provided the only method of competition in utility rates now open to the people. It was opposed on the ground that when the people adopted the regulatory system in 1907 they deliberately substituted it for competition and have made competition impossible by restricting the existing companies to only such returns as money ordinarily earns in the security market.

Would Not Be Allowed to Discontinue Service for Non-Payment.

A bill was recently introduced into the New York assembly to amend the public service commission law, in relation to discontinuance of service by certain corporations in case of disputed claims, by adding new Section 24-a:

Telephone companies, among others, would not be allowed to discontinue service rendered to a subscriber on account of the failure of such subscriber to pay the charges demanded, if the subscriber disputes the charge upon the ground that it is unreasonable and excessive and offers to pay into the court in an action instituted by the corporation, for the recovery of such charges a reasonable sum in payment for the services rendered.

U. S. Supreme Court Opinion Denying City Right to Intervene.

In the opinion written by Chief Justice Taft in connection with the decision rendered by the United States Supreme Court March 12—rejecting the intervention of New York City in the Bell rate case with the New York Public Service Commission—it was stated that there was no necessity for the city to enter the legal controversy between the commission and the New York Telephone Co. over telephone rates.

Dismissing an appeal by the city of New York and upholding the federal district court in New York City, the supreme court said very plainly that the commission was amply able to represent the public, especially as it had been said there was complete coöperation between the commission, the attorney general and the state, and the city.

The only interest the city had in rates, the Taft opinion added, was as a subscriber, and even in that respect it was

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in a peculiar attitude, for its own telephone rates were settled by a special contract.

Attention was called by the court to the fact that it had already decided in the same way in the case of New York City against the Consolidated Gas Co., and that not long ago it stated in another telephone case that one defendant was all that was necessary.

The opinion cited the case of Englehard, 231 United States 646—an action brought against the city of Louisville, Ky., to restrain the enforcing of an ordinance prescribing telephone rates.

One of the subscribers filed a petition in the district court asking to be made a party defendant. This was denied and the petitioner sought in United States Supreme Court a mandamus to compel the district judge to grant the petition.

It was pressed upon the court that the petitioner had a common interest with other subscribers in the rates under discussion and that under equity rule No. 38, when the question is one of general interest and it is impracticable to bring them all before the court, one may sue or defend for all.

The higher court held that the city was the proper defendant in the suit as the representative of all. The court said:

"It is the universal practice, sustained by authority, that the only mode of judicial relief against unreasonable rates is by suit against the governmental authority which established them or is charged with the duty of enforcing them."

However, in the New York case, Justice Taft said in the opinion:

"There is nothing in this case to show that the public service commission will not fully and properly represent the subscribers resident in New York City."

Asks Leave to Take Over Thousand Islands (N. Y.) Company.

The Northern New York Telephone Corp., of Plattsburgh, petitioned the New York Public Service Commission on March 16 for authority to acquire the issued and outstanding stock of the Thousand Islands Telephone Co., of Clayton, and to merge the latter company with the Northern New York company.

Authority is also requested to issue $55,400 in 6½ per cent cumulative preferred stock to be given to the stockholders of the Thousand Islands company in exchange for all of the common stock of the latter company.

Charge Ohio Bell with Extravagance in Dayton Building.

Charges of extravagance in rebuilding the Garfield exchange in Dayton were made against the Ohio Bell Telephone Co., at the hearing held March 9 before the Ohio Public Utilities Commission.

In splitting the business district on the Main and Garfield exchange, the company has shown extravagances which will never be justified from a service standpoint, was the substance of one point brought out at the hearing.

The split exchange necessitates double equipment, witnesses for the city declared.

G. R. Johnston, one of the engineers employed by the city, testified that the company could increase its revenues by installing four-party lines at a rate of from $15 to $24 yearly.

The entire week of April 23 has been set aside to give the telephone company attorneys an opportunity to cross-examine witnesses produced by the city.

Summary of Commission Rulings and Schedule of Hearings.

INTERSTATE COMMERCE COMMISSION.

March 5: Application filed by Chesapeake & Potomac Telephone Co. for approval of the acquisition by it of the property formerly operated by the Wellsburg Home Telephone Co. at Wellsburg, W. Va.

March 17: Hearing held in Washington on petition of Pacific Telephone & Telegraph Co. for authority to take over the Willamette Telephone Co., of Dallas, Ore.

CALIFORNIA.

March 12: Petition filed by C. W. and M. A. Forbes, owners of the Manteca Telephone Co., of Manteca, for authority to transfer to the company the plant and equipment used in the operation of the exchange, for 400 shares of the capital stock of the corporation.

The company asks authority to issue 15 shares of its stock of the par value of $100 a share, to secure funds to purchase a lot and erect a building for the use of

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the company. Authority is also sought to issue 20 shares to finance construction necessary to enlarge the plant and system. The company wants, in addition, to borrow $8,000 on its note, the funds to be used in meeting the cost of constructing its proposed new building.

March 13: Complaint filed by El Monte Chamber of Commerce, requesting that the Pacific Telephone & Telegraph Co. be required to grant free switching service between the Rosemead district and El Monte, alleging that there is a discrimination in favor of the city of Alhambra, which has free service with the Rosemead district.

ILLINOIS.

March 9: Order entered suspending until June 26 the proposed increased rates in Winchester of the Scott County Telephone Co.

March 20: Hearing held at Springfield in the matter of complaint of H. E. Ogle and others relative to increased rates, toll charges, service and discontinuance of service in Home Telephone Co. in Arenzville and vicinity; also hearing on complaint of C. Bliming and others against the same company, alleging insufficient service, etc., at Concord and vicinity.

March 22: Hearing held at Springfield in the matter of joint application of the Mt. Carroll Mutual Telephone Co., of Mt. Carroll, and Carroll County Independent Telephone Co., of Savanna, for approval of sale by former and purchase by latter of property in Mt. Carroll, for $16,000; also application of the Carroll County company for authority to issue its first mortgage bonds in the amount of $90,000.

KANSAS.

January 22: Complaint of the city of Liberal against the Liberal Telephone Co., regarding police-call system, dismissed without prejudice.

January 24: Application of the Lyndon Mutual Telephone Co. for permission to make certain changes in rates and service at Lyndon; dismissed.

January 31: Vermillion Valley Telephone Co. authorized to sell its plant and property in Mill Creek and Vienna townships to the American Telephone Co.

February 2: W. B. Rhodes given permission to sell his telephone plant and property at Lake City—known as the Ranchmen's Telephone Co.—to George H. Lockhert.

February 2: Application of G. H. Lockhert for a certificate of convenience and authority to transact business of a public utility, allowed.

February 19: Authority granted the Olsburg Telephone Co. to sell its plant and property at Olsburg to G. H. Hanson.

February 23: Permission issued to R. E. Young and M. F. McCune to sell their telephone plant and property at Zenda to R. E. Young.

February 23: Application of R. E. Young and M. F. McCune for permission to sell their telephone plant and property at Nashville to M. F. McCune, allowed.

February 23: Application of M. F. McCune of Nashville, for a certificate of convenience and authority to transact the business of a telephone utility, allowed.

February 26: Application of the city of Independence for a reduction of rates for local exchange and rural telephone service, and for the establishment of a fair and reasonable rate for such service; both parties to the above controversy agreed to accept the rates and rules filed with the commission on October 1, 1921, by the Kansas City Long Distance Telephone Co., of Independence, for a period of six months, beginning March 1, 1923, with the

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following change in its collection rules: A discount of 25 cents to be allowed on all residence rates paid on or before the 10th of the month. Allowed.

March 3: Circleville Independent Telephone Co. authorized to sell its plant and property at Circleville to C. Evey.

March 3: Crawford Telephone & Telegraph Co. granted a certificate relating to a proposed issue of its notes secured by mortgage in the amount of $12,500.

March 5: Application of R. E. Young, of Zenda, for a certificate of convenience and authority to transact the business of a public utility, allowed.

March 7: Application of the United Telephone Co. for a certificate relating to a proposed issue of its preferred stock in the amount of $19,800, allowed.

March 8: D. S. Forshee and J. A. Metcalf, partners doing business under the name F. & M. Telephone Co., granted a certificate of convenience and authority to transact the business of a public utility at Ulysses and other towns.

March 9: Application of the Cherryvale Telephone Co., of Cherryvale, for a certificate relating to a proposed issue of its preferred stock in the amount of $45,000, allowed.

MICHIGAN.

March 9: Authority given Tecumseh Telephone Co., of Tecumseh, to increase its business rates 50 cents and its residence rates 25 cents a month.

MINNESOTA.

April 13: Hearing to be held at Mabel on application of the Mabel Telephone Exchange Co. for authority to increase its local and rural switching charges.

NEBRASKA.

March 12: Application filed by Hill Independent Telephone Co. of Niobrara for authority to assess shareholders for maintenance and to deny service to those who refuse to pay.

March 12: Application filed by Nordhous Bros. to require Northwestern Bell to give toll service on farmer lines operated by the Wareham Farmers Telephone Co.

March 12: Application filed by the Hay Springs Telephone Exchange for ruling as to what is proper charge for owners of telephone instruments who secure connection with company lines by being switched by farmers who pay monthly rental charges.

March 13: Complaint filed by A. J. Cook that the Farmers & Merchants Telephone Co., of Regan, is requiring payment of telephone service six months in advance, while refusing at the same time to better service, accompanying demand with the threat to cut off all who refuse to obey the new rule.

March 13: Application filed by Havana Telephone Co. for a ruling as to whether a person who pays for business service has a right to use the residence telephone of neighbors.

March 14: Application of the Stanton Independent Telephone Co. for permission to destroy ancient records, held to be reasonable and granted.

March 14: Application filed by the Palisade Telephone Co. for permission to issue additional stock to cover the difference in property value between the present issue of $3,050 and the value of the physical plant.

March 15: Request filed by George McKown, rural subscriber of Northwestern Bell Telephone Co., asking for a ruling as to whether a farmers' mutual company organized to take over the rural lines to which he is attached, can deny him continued service if he refuses to comply with the demand that he buy stock in the mutual company.

NEW YORK.

March 14: Hearing held in Albany on capitalization matters involved in the formation of the Rochester Telephone Corp.; Milo R. Maltbie, of New York City, cross-examined by Mr. Goodwin, representing the company, as to details of the valuation figures which he submitted; testimony of Harry Engh, of Rochester, engineer who prepared the appraisal of the company, also taken; adjournment taken to March 21 at Rochester.

March 16: Application filed by Northern New York Telephone Corp., of Plattsburgh, for authority to acquire stock of Thousand Islands Telephone Co., of Clayton, and to merge the two companies; also to issue stock in exchange for Thousand Island stock.

March 23: Hearing held at Buffalo on complaint of city of Jamestown and Jamestown chamber of commerce as to rates of Jamestown Telephone Corp.

OHIO.

March 9: Hearing held in Columbus on rates of Ohio Bell Telephone Co. for service in Dayton; adjourned to March 21 and 22 at Columbus.

April 23: This week set aside for cross-examintion by attorneys for Ohio Bell Telephone Co. of witnesses for the city in the Dayton rate case.

OREGON.

March 15: Hearing resumed at Portland in rate case of Pacific Telephone & Telegraph Co.

PENNSYLVANIA.

March 5: New rate schedule, effective April 1, filed by Wiconisco Telephone & Telegraph Co., of Elizabethville.

TENNESSEE.

March 22: Hearing held in Nashville on complaint of the town of Kingsport as to the rates of the Intermountain Telephone Co.

WEST VIRGINIA.

March 10: Application filed by Silver Hill Telephone Co., operating in Marshall and Wetzel counties, for authority to increase its rates.

March 30: Hearing to be held at Charleston on petition of Pocahontas Telephone Co., of Marlinton, for increased rates.

WISCONSIN.

March 13: Authority given Freeman Telephone Co., of Ferryville, to place in effect, as of April 1, increased rates.

March 13: Hampden Farmers Telephone Co.—which receives switching service from the Columbus exchange of the Wisconsin Telephone Co.—authorized to increase rate.

March 13: After a rehearing, held on petition of rural subscribers of the Edgerton exchange of the Commonwealth Telephone Co., of Madison, order entered reaffirming former order in favor of the company.

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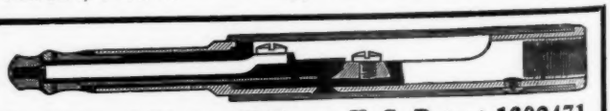

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